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United States Patent [19]

Fisher

[11] **Patent Number: 5,746,458**

[45] **Date of Patent: May 5, 1998**

[54] **EASILY INSTALLABLE DELAYED EGRESS LOCK SYSTEM**

[75] Inventor: **Roy E. Fisher**, Dover, Ark.

[73] Assignee: **Ralph's Welding Inc.**, Russellville, Ark.

[21] Appl. No.: **909,035**

[22] Filed: **Aug. 11, 1997**

Related U.S. Application Data

[63] Continuation of Ser. No. 645,179, May 13, 1996, abandoned.

[51] **Int. Cl.**^{6} **E05C 19/00**

[52] **U.S. Cl.** **292/252**; 292/144; 292/341.16

[58] **Field of Search** 292/252, 92, 144, 292/341.15, 341.16, 148; 248/544; 411/348

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Primary Examiner—Steven N. Meyers
Assistant Examiner—Gary Estremsky
Attorney, Agent, or Firm—Stephen D. Carver

[57] **ABSTRACT**

An easily installed delayed egress lock system that comprises a control module and a latching mechanism attached to the door jamb and a bolt attached to the door. The control module comprises a shell that houses the control circuitry. The latch mechanism comprises a casing that houses a keeper and actuator, two interconnecting channels for retaining the keeper and actuator, and an electrical solenoid. The mechanism also defines a port that receives the bolt when the door is shut. The bolt comprises an elongated body supported by a base and terminating with a spaced-apart head. Preferably, the primary door lock signals the control module when released to start counting down a preselected time period. At the end of the time period, the solenoid deactivates to unlock the door. In the preferred embodiment, the keeper comprises a ball while the actuator comprises a larger ball. The bolt for all embodiments defines a seat that receives the keeper. Installation of the system may be accomplished by first securing the control module and latch mechanism to the door jamb. Next, the bolt is locked into the port with marking dyes covering on each bolt base attachment point. When the door is forcibly shut, the resulting imprint on the door marks the attachment points.

5 Claims, 11 Drawing Sheets

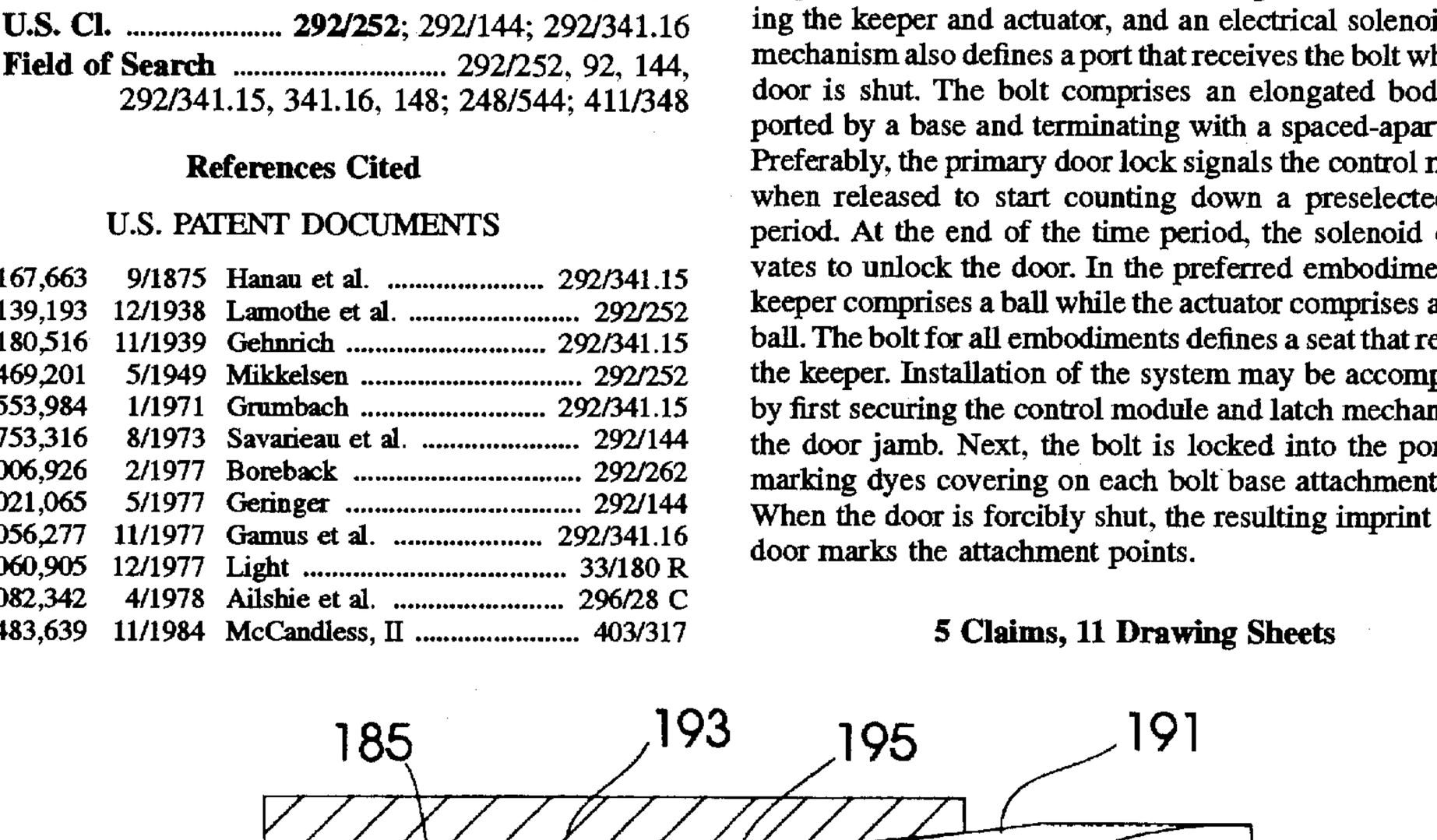

FIG.1

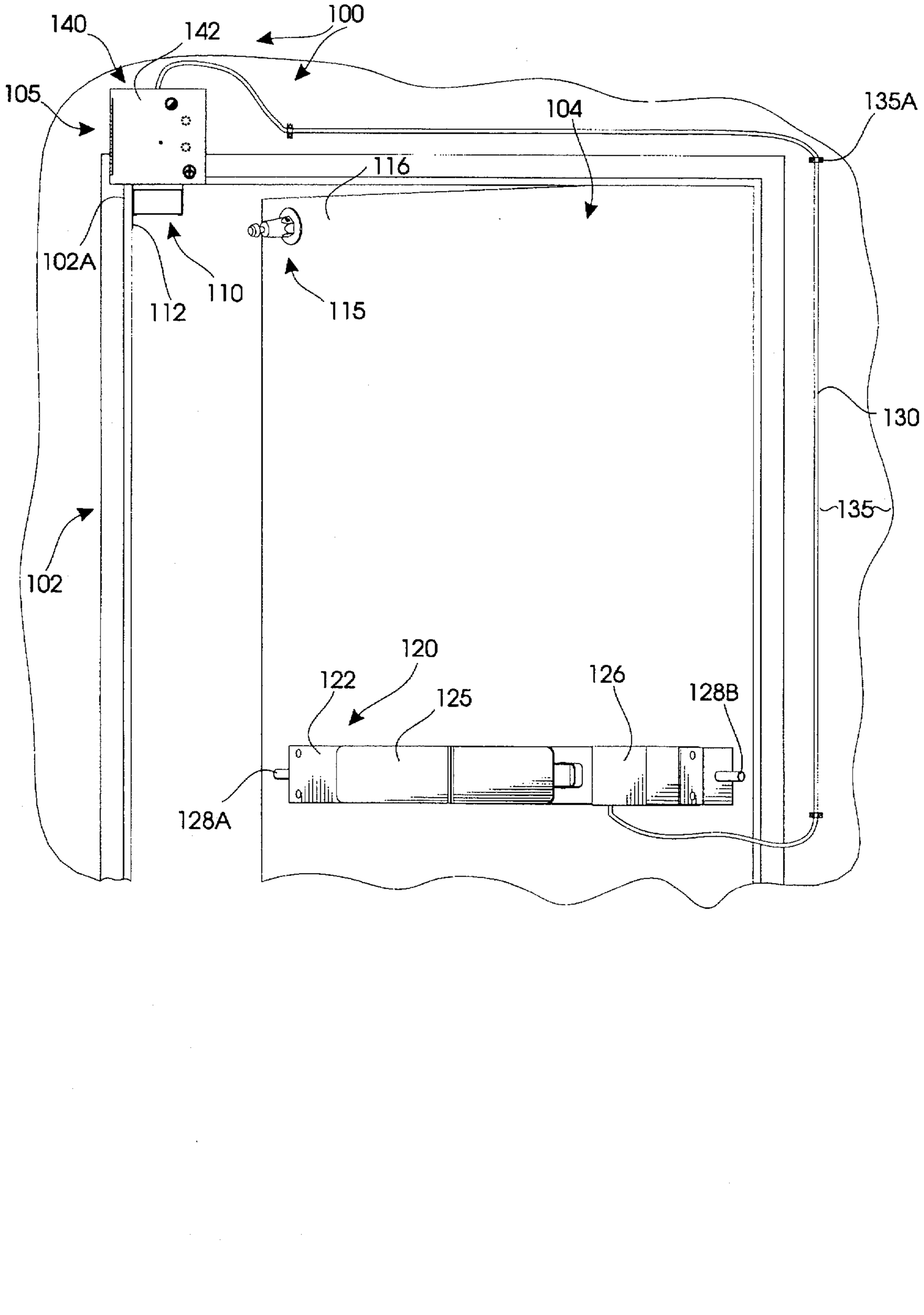
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FIG. 2

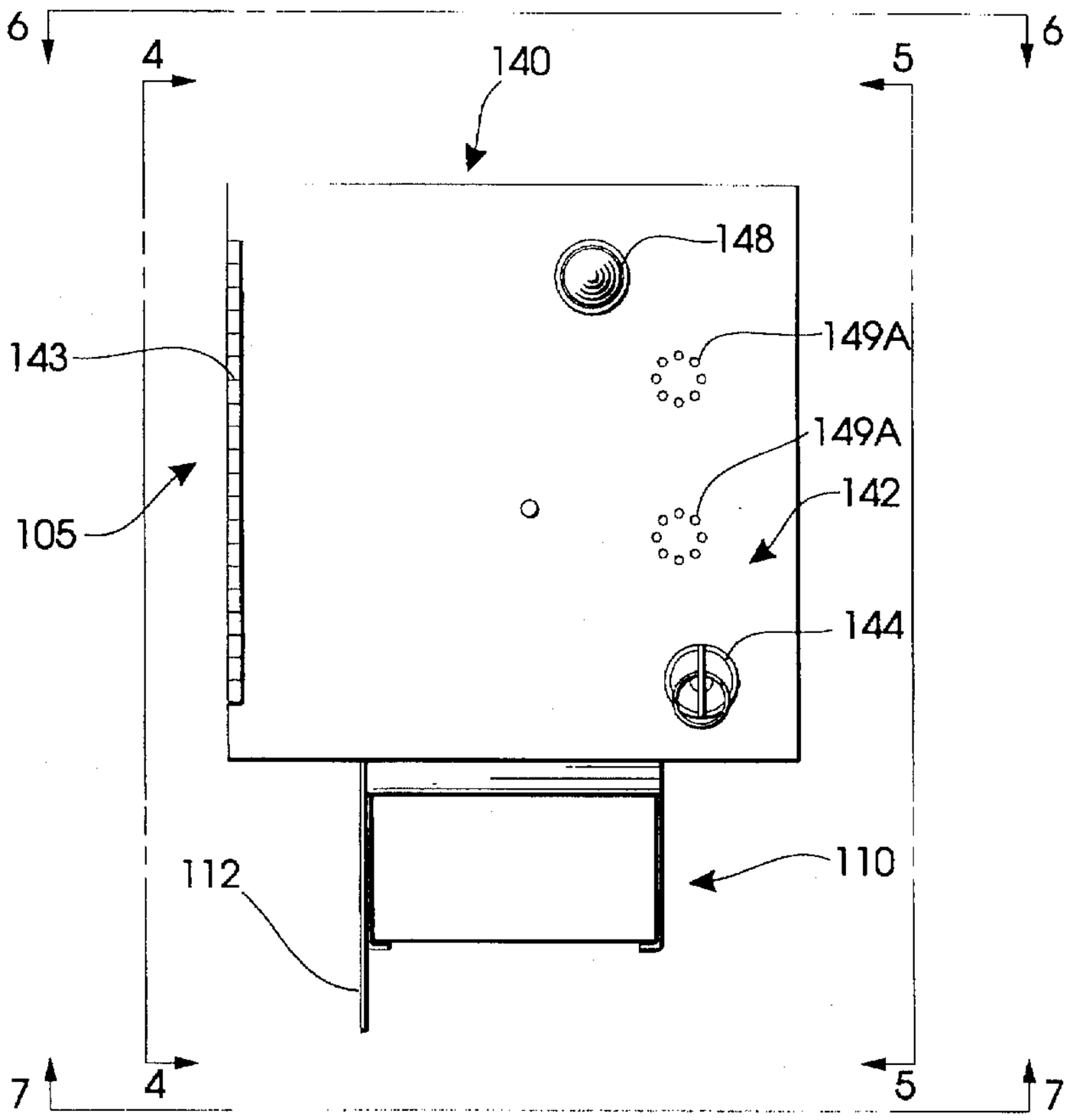
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FIG. 3

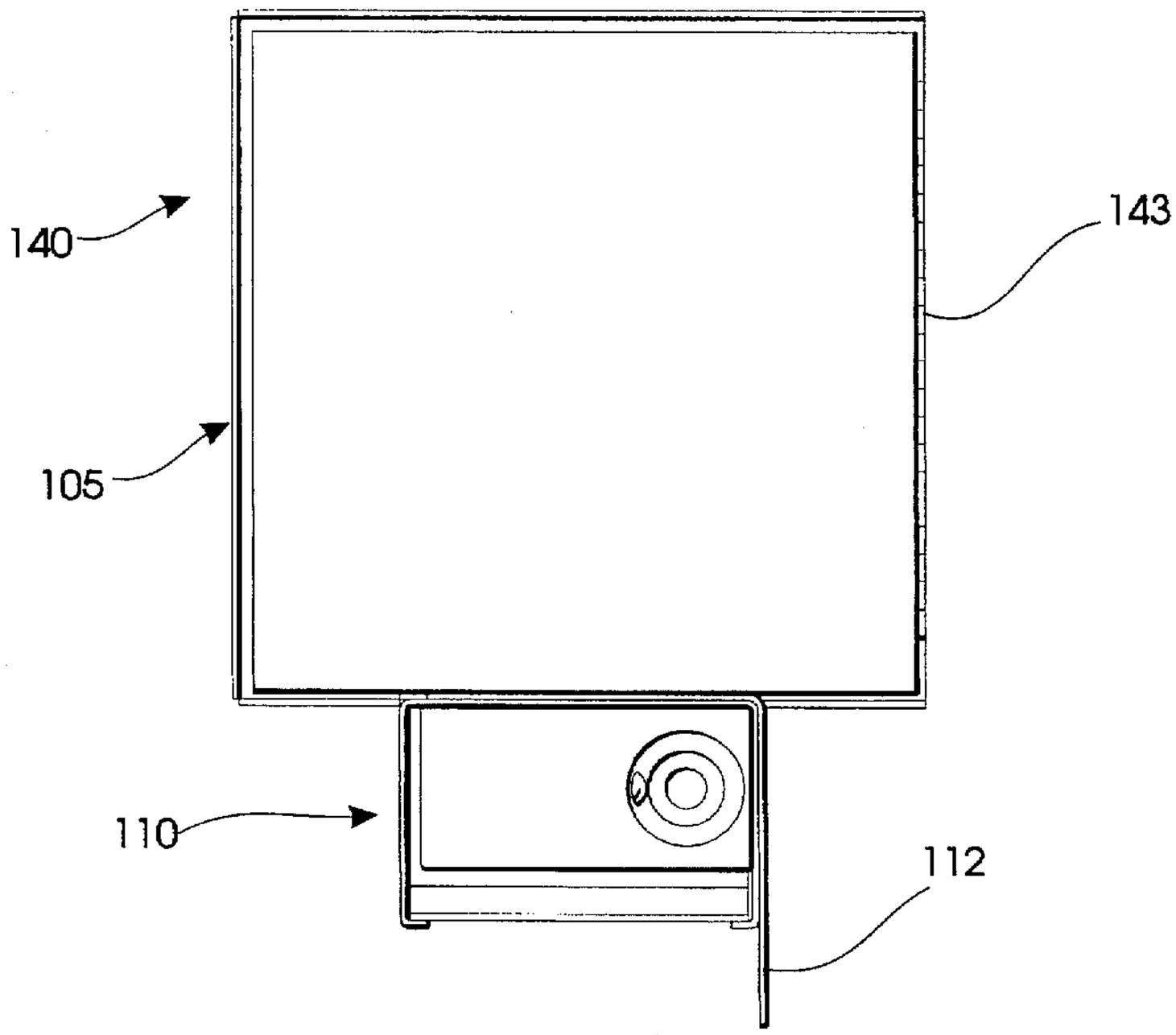
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FIG. 4

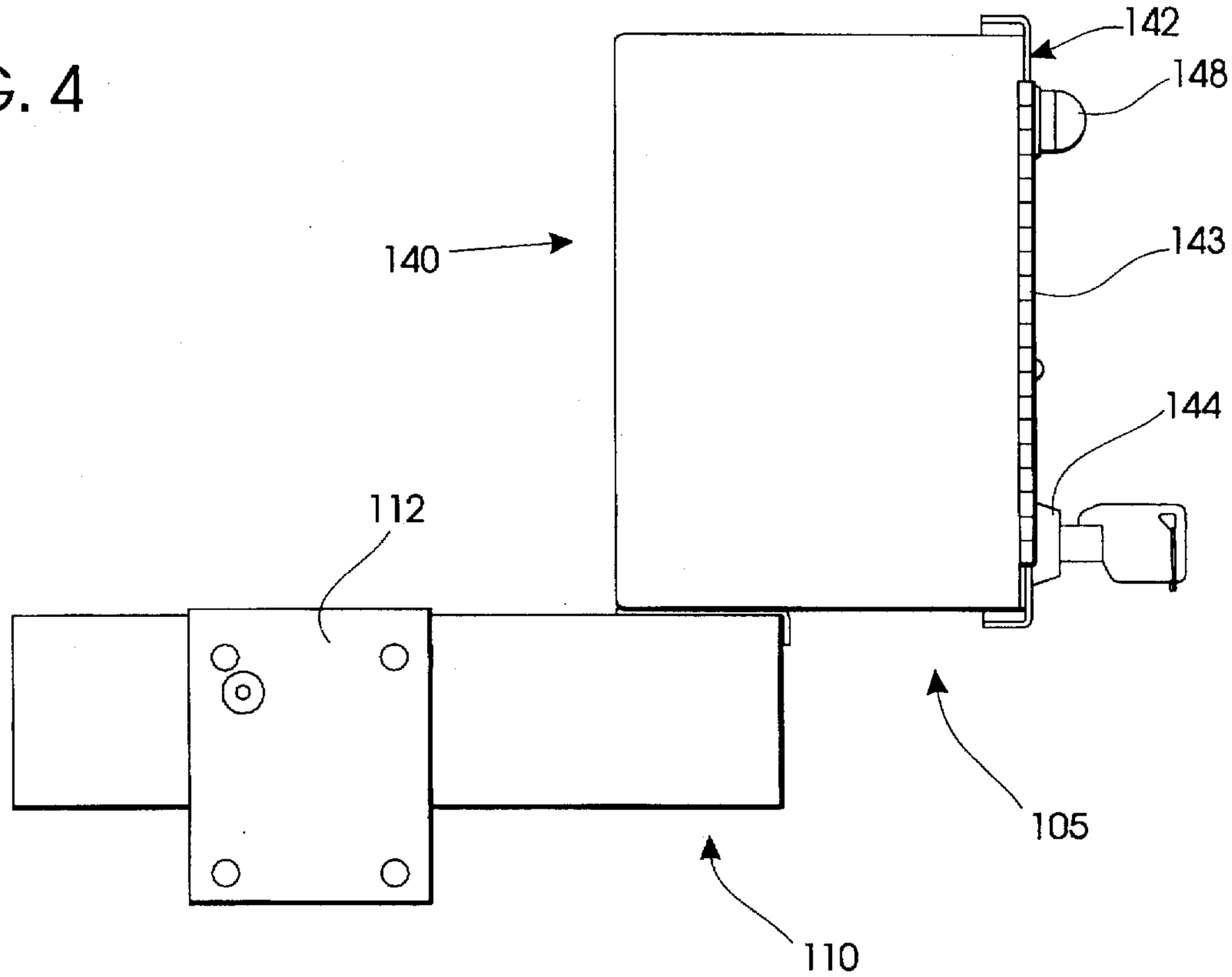


FIG. 5

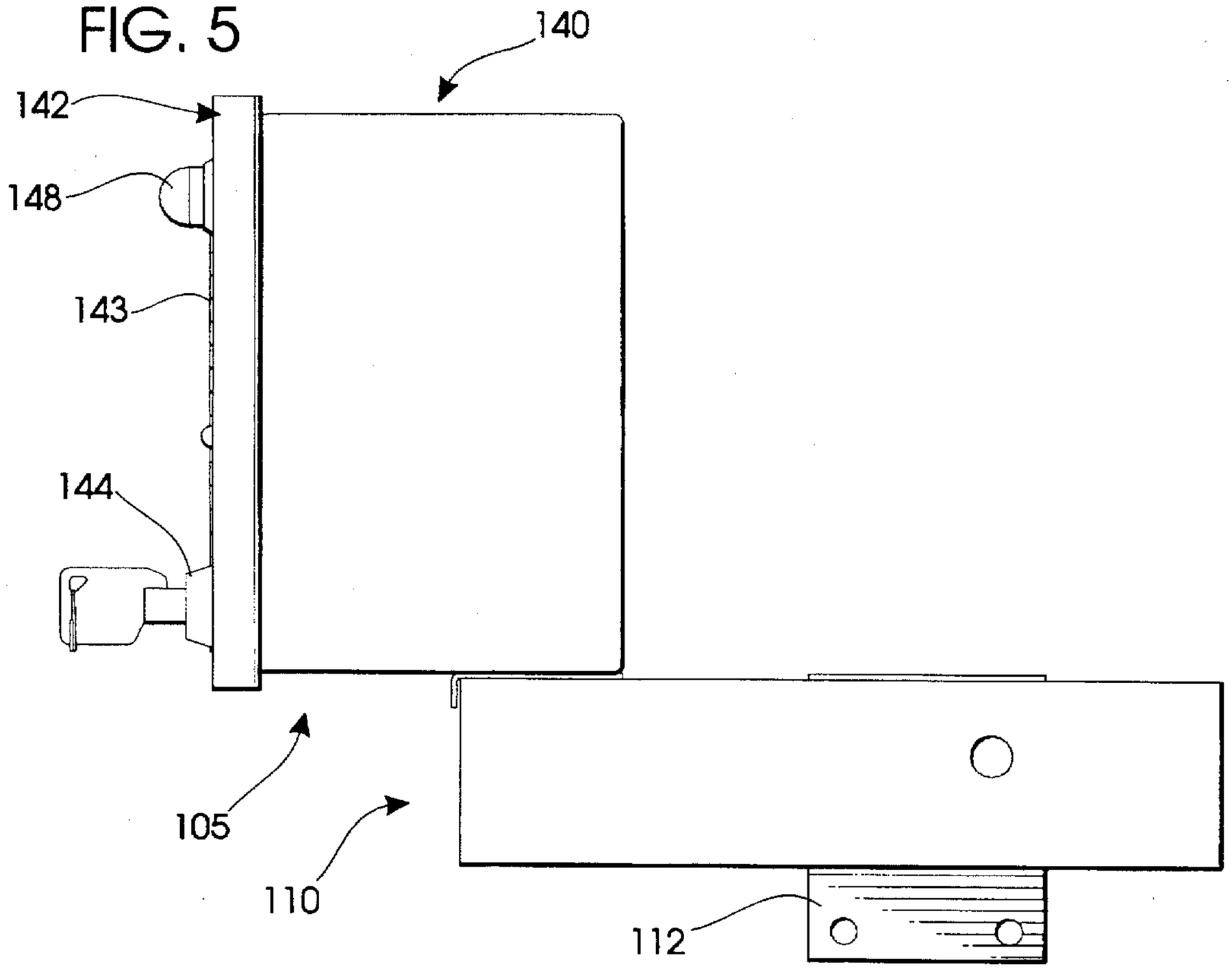


FIG. 6

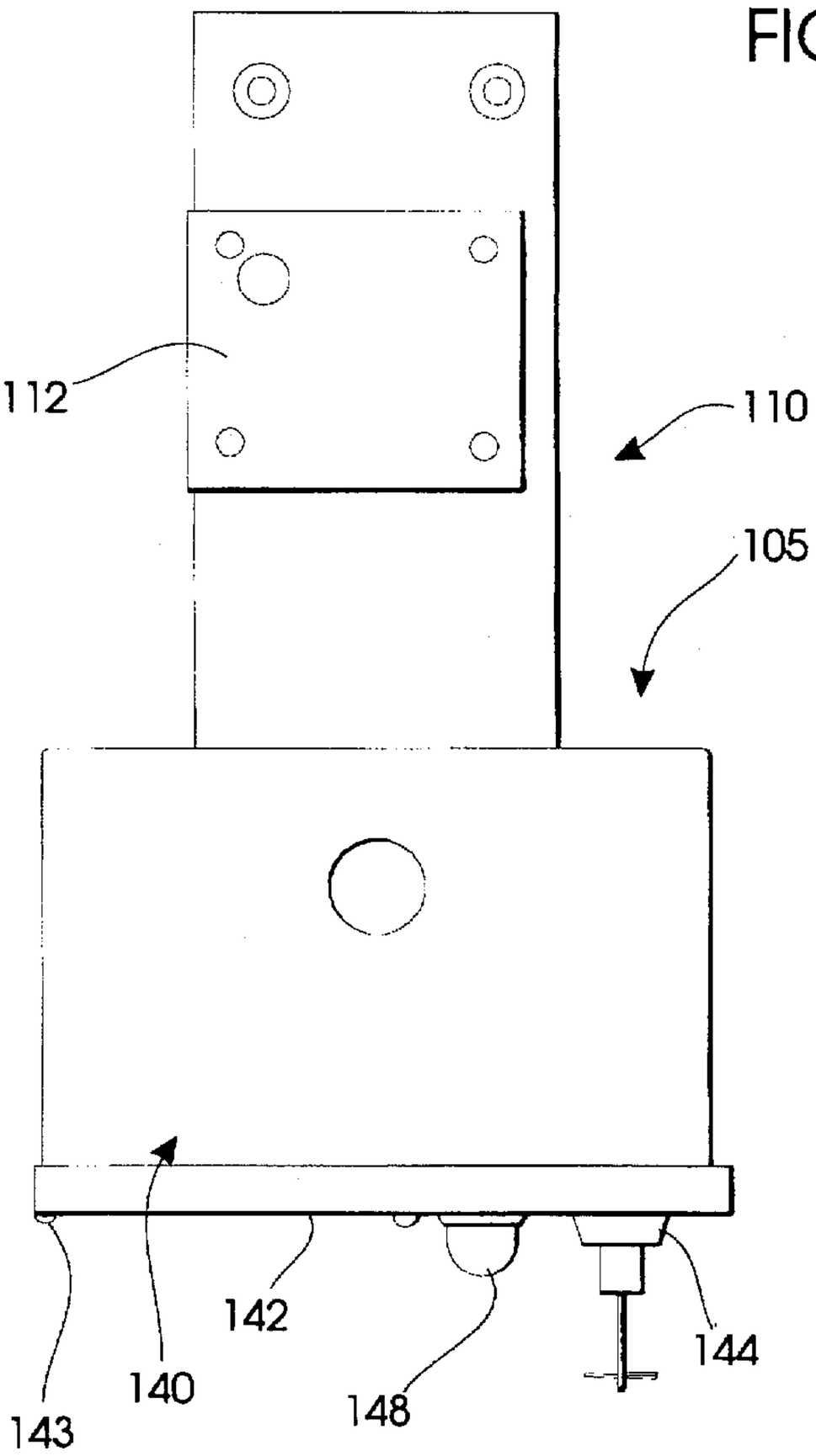
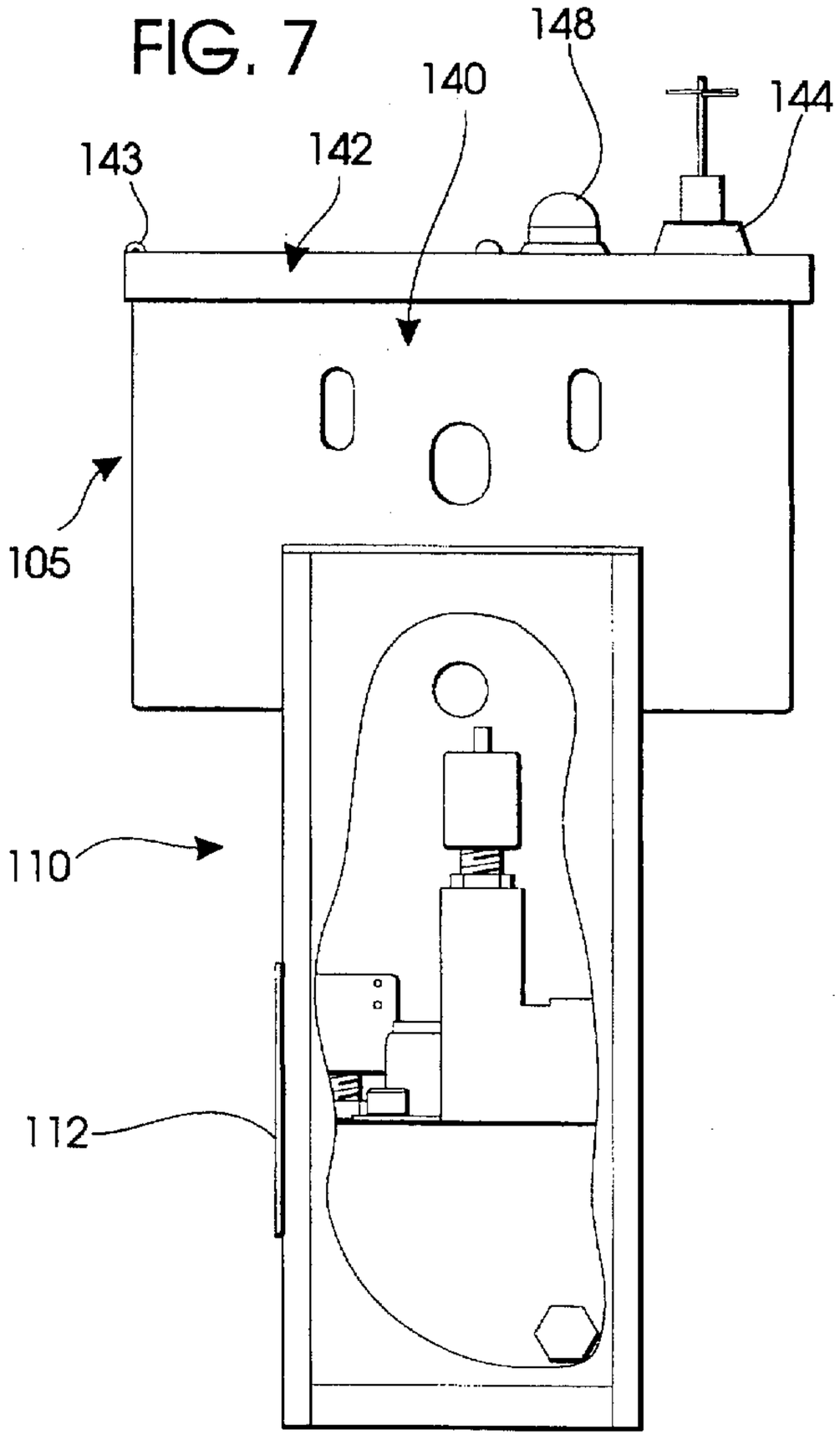


FIG. 7



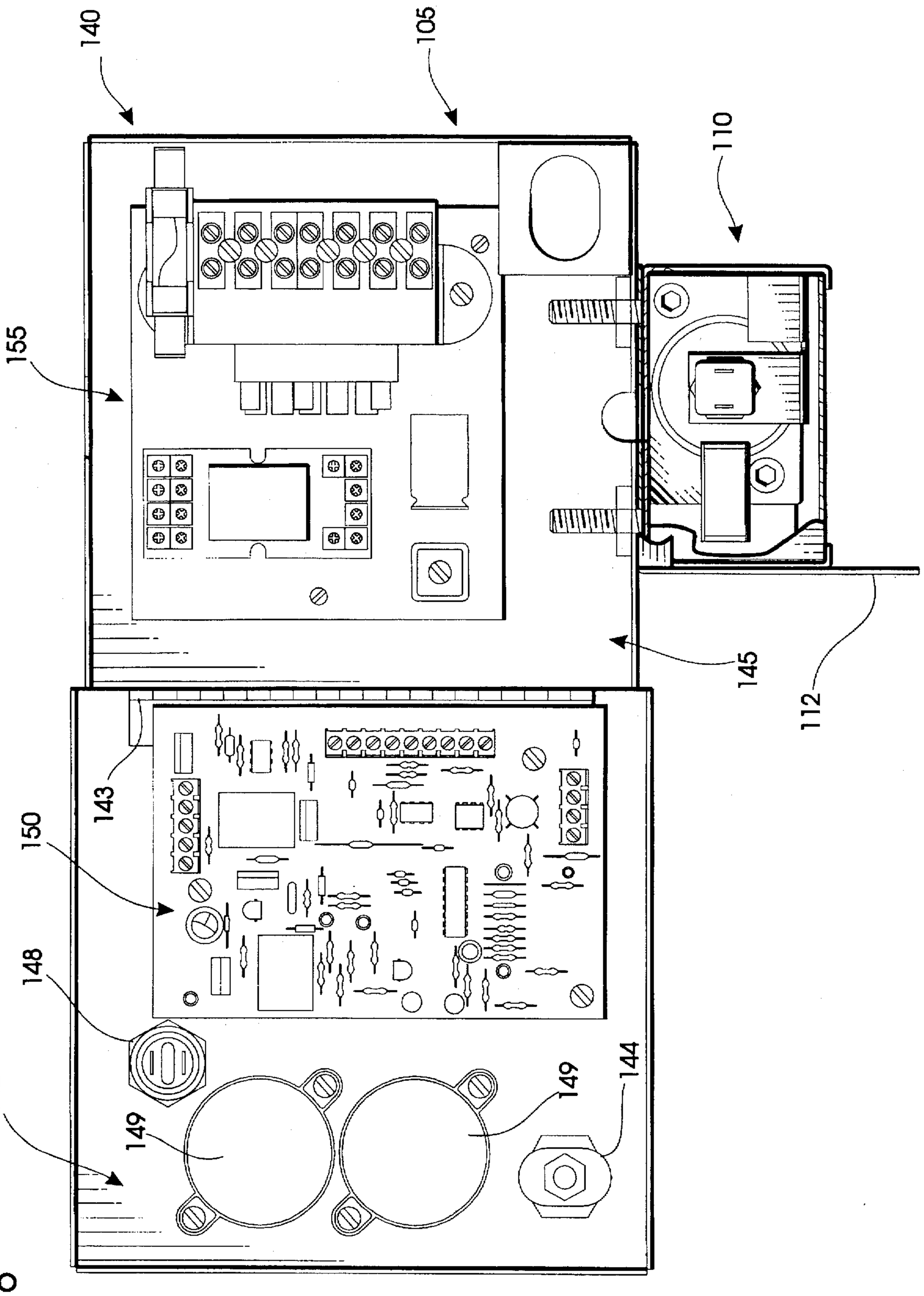


FIG. 8

FIG. 9

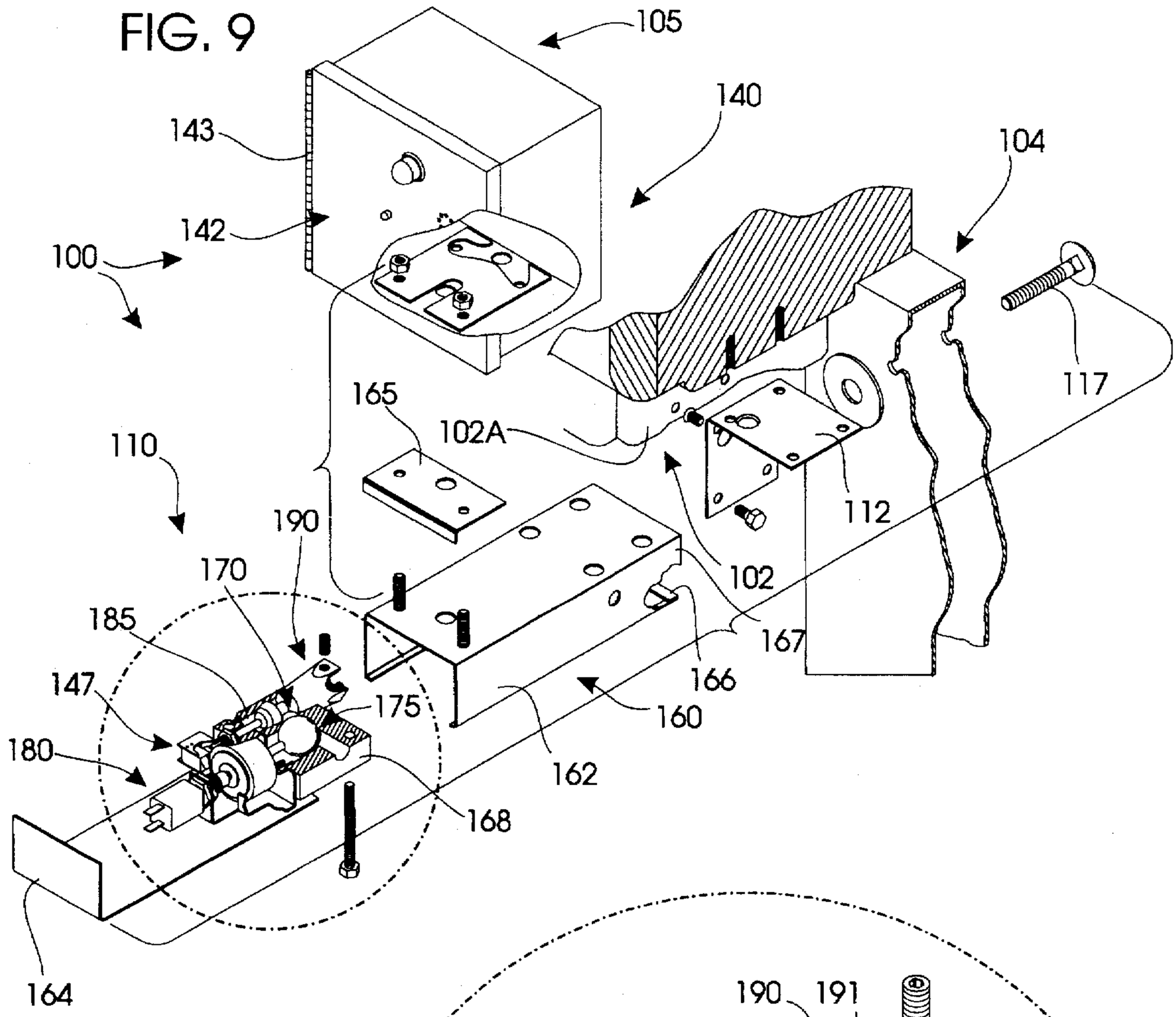

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FIG. 9A

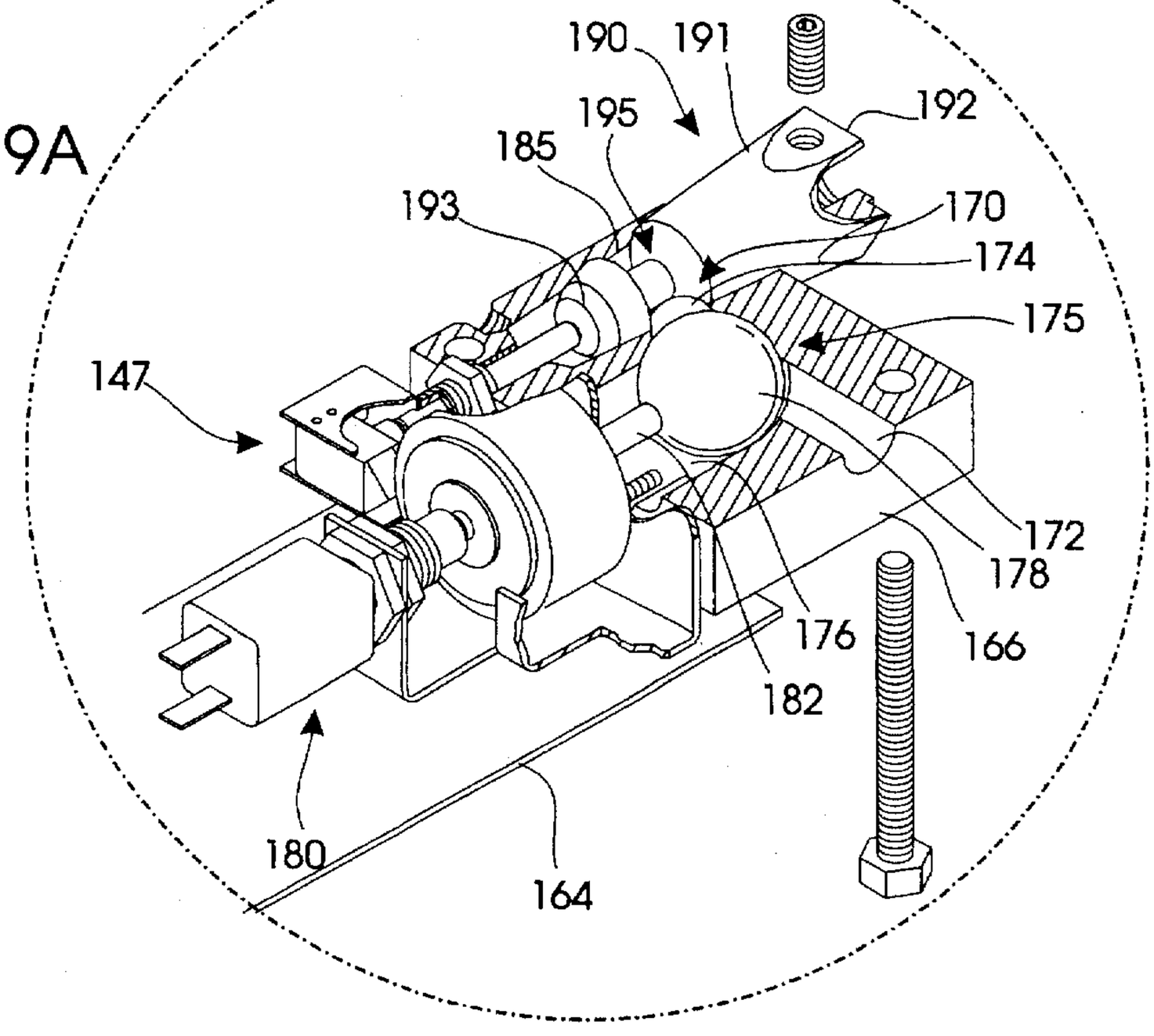
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FIG. 10

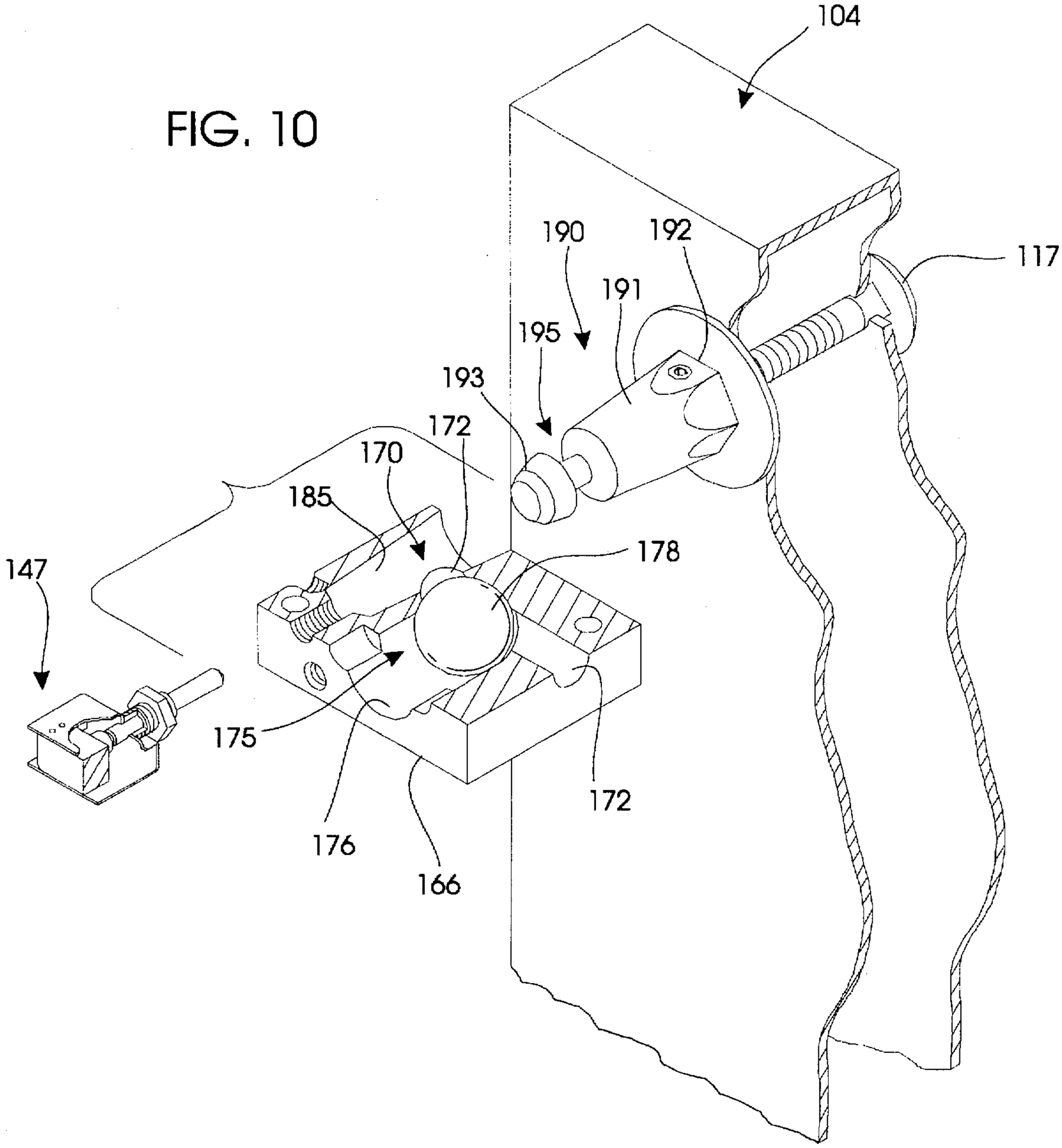

FIG. 11

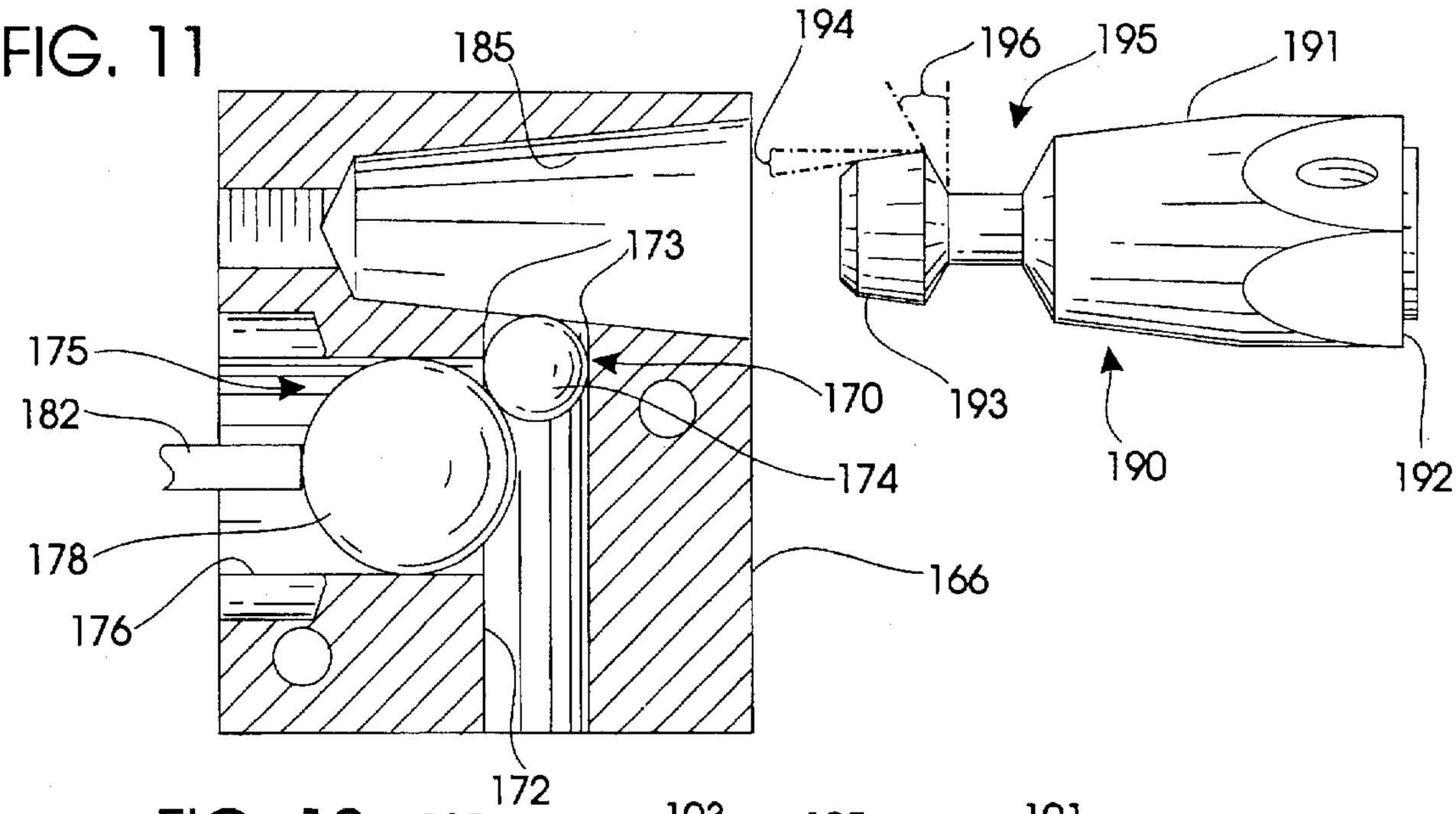

FIG. 12

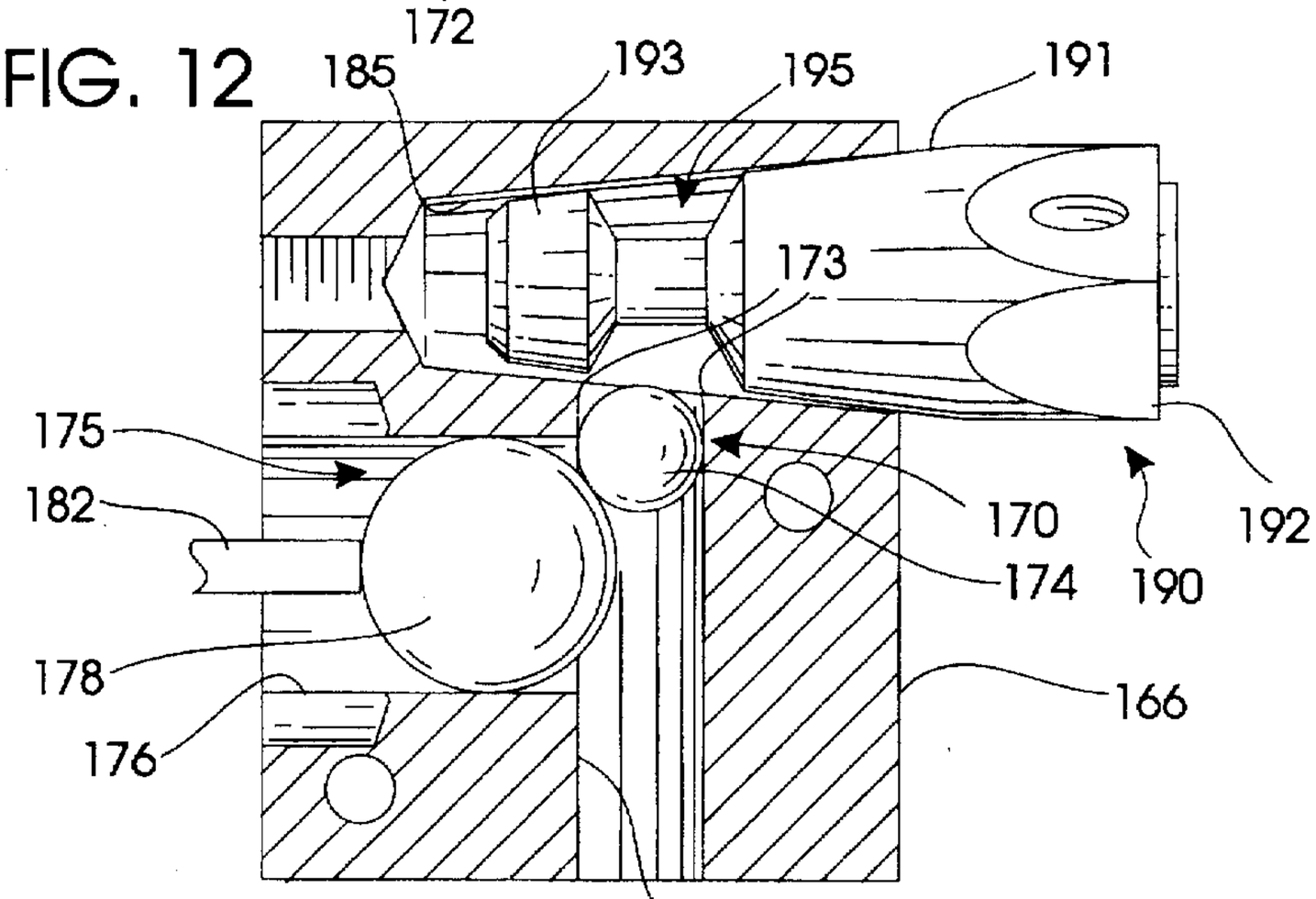

FIG. 13

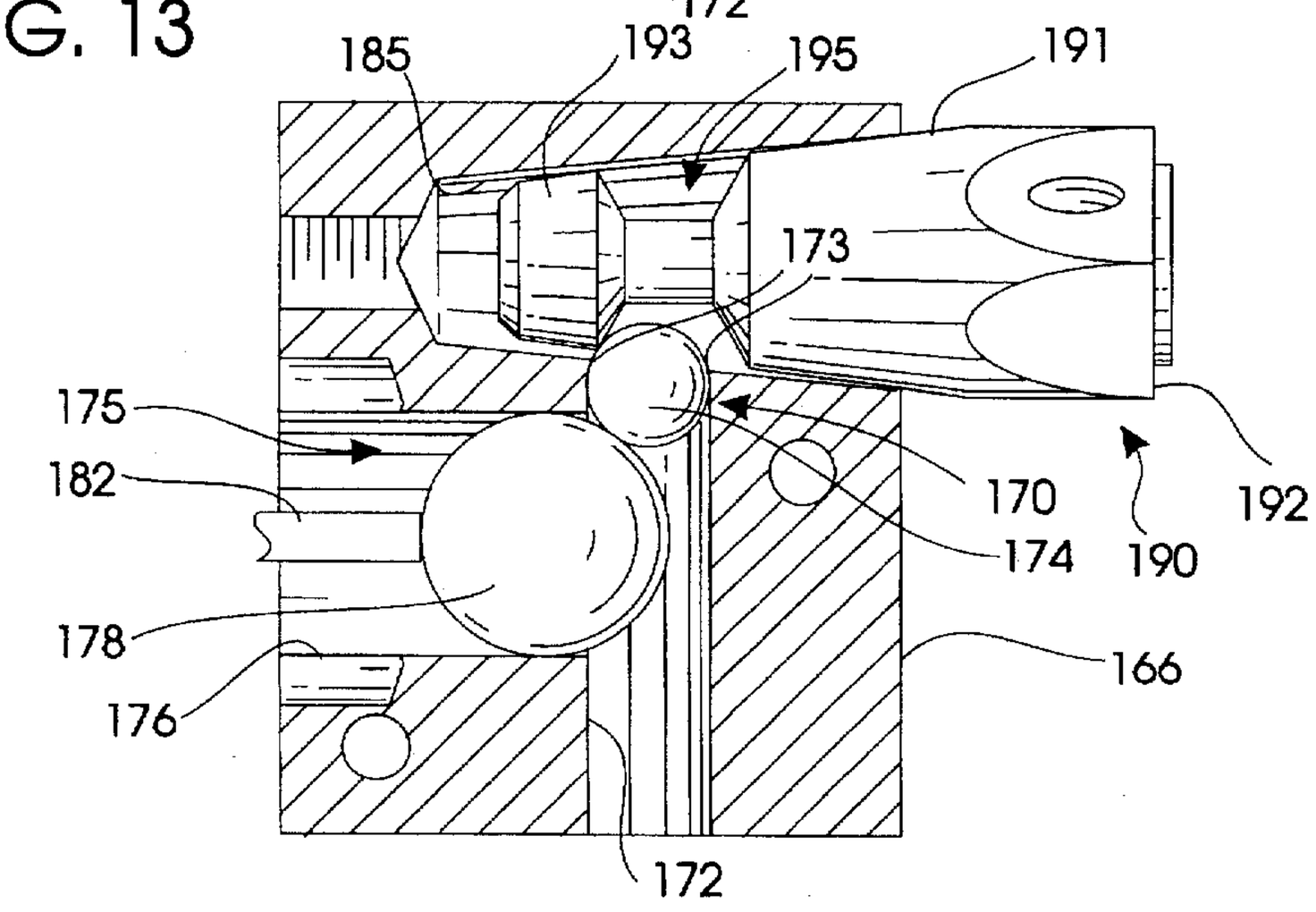

FIG. 14

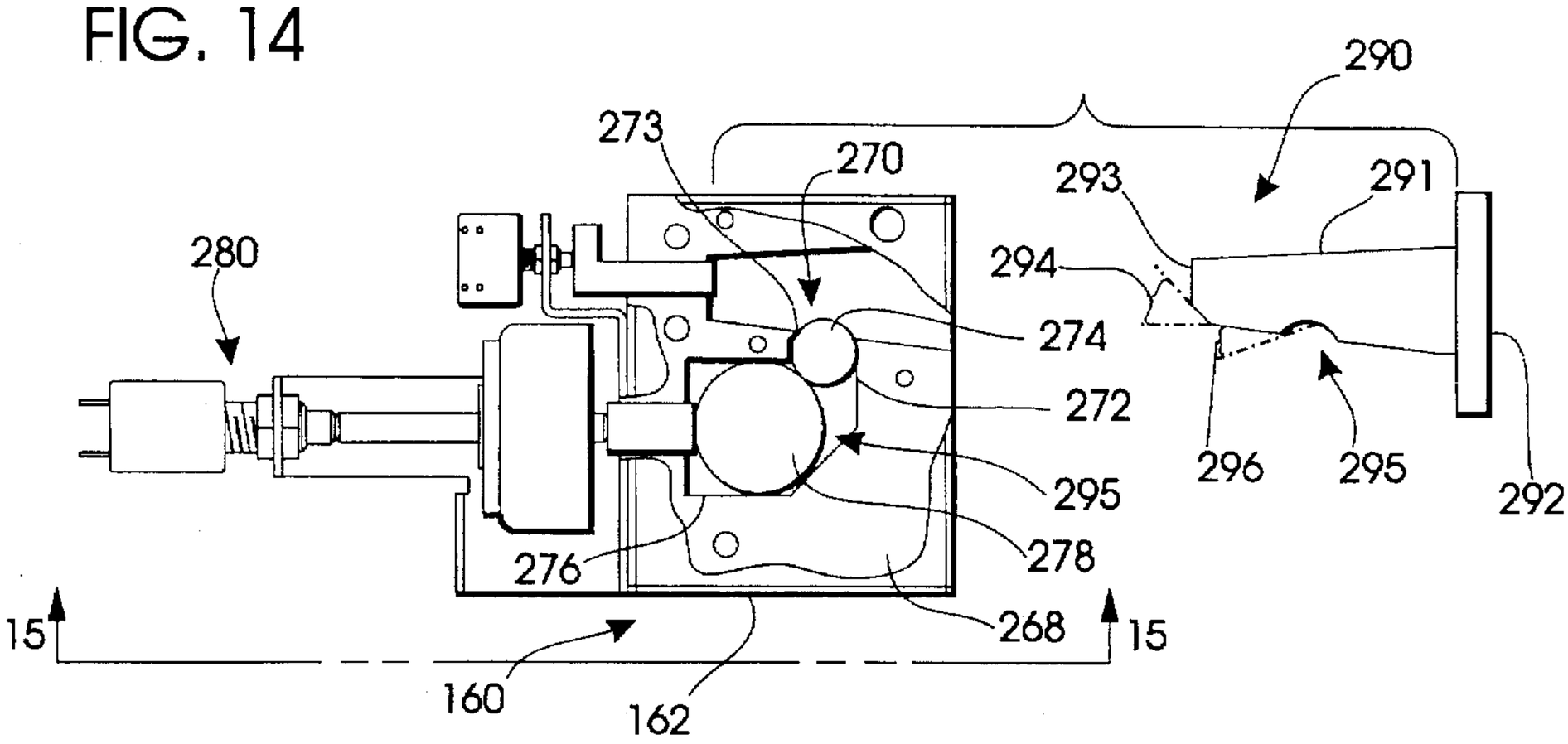

FIG. 15

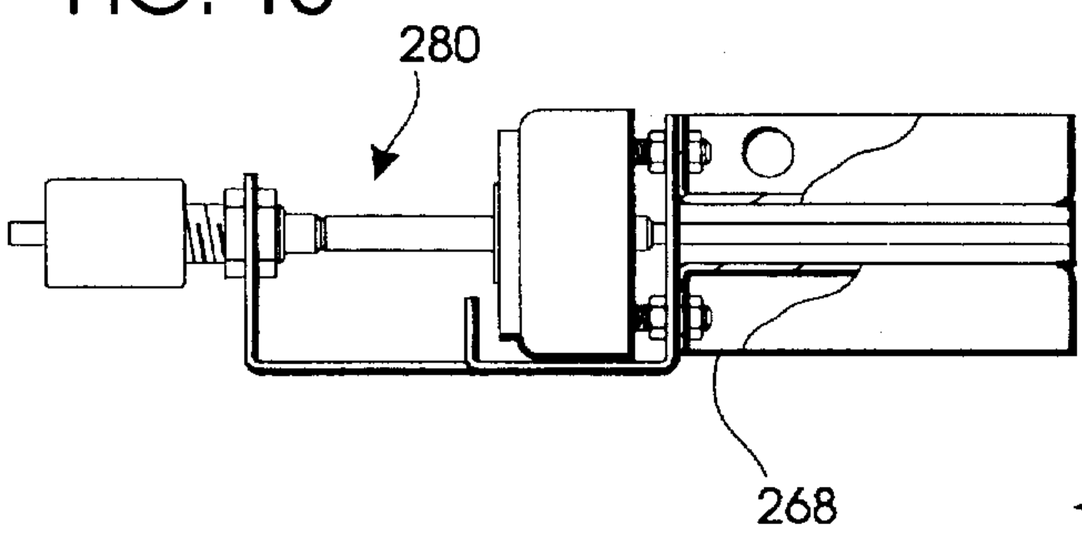

FIG. 16

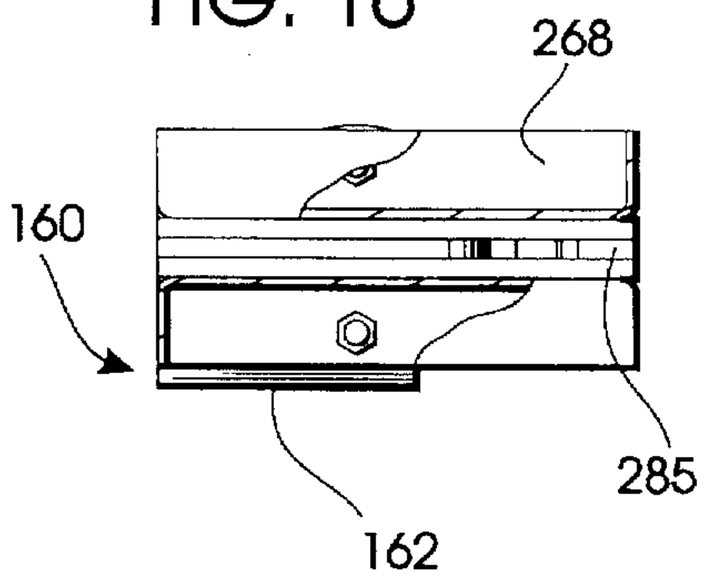

FIG. 18

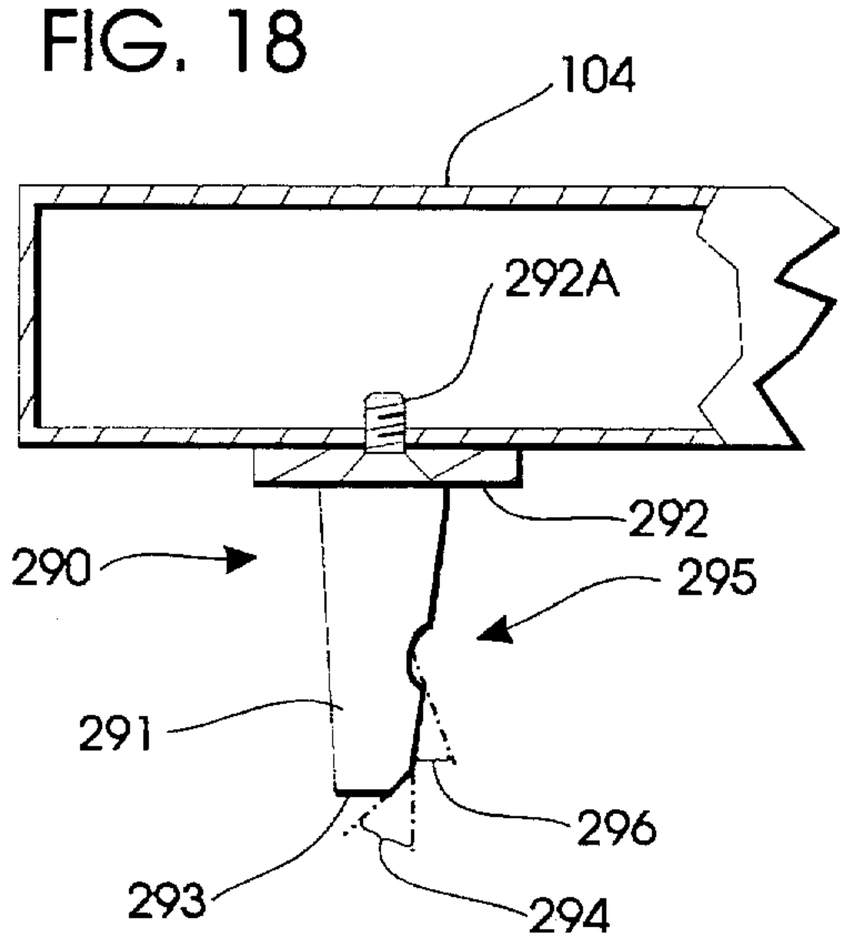

FIG. 17

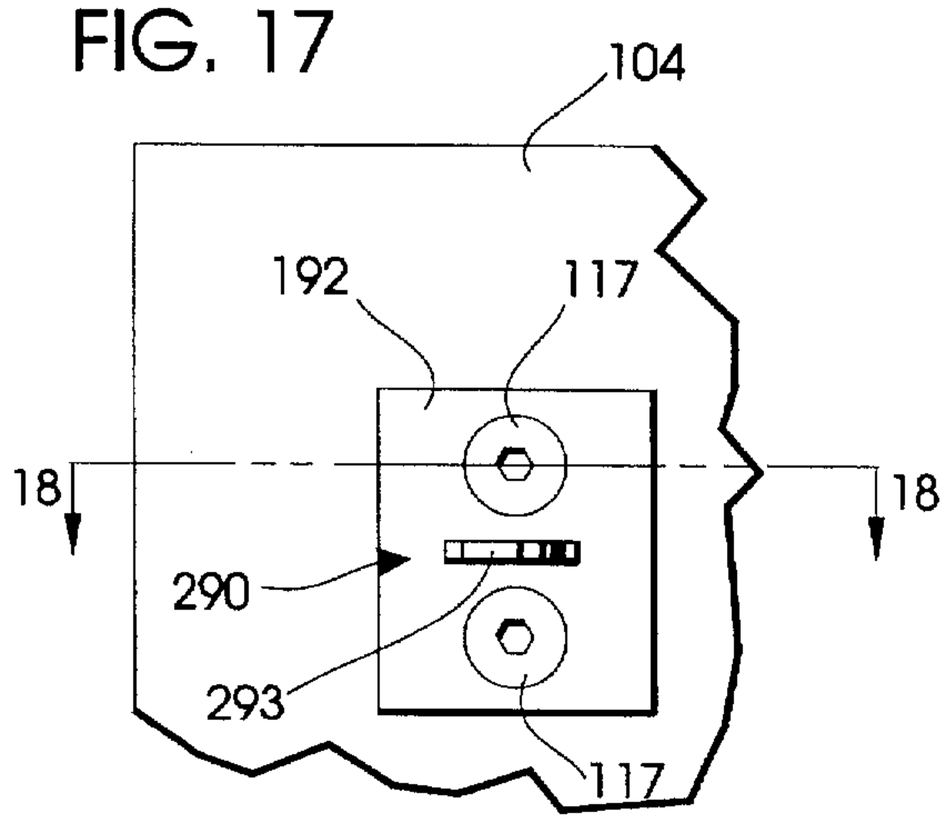

FIG. 19

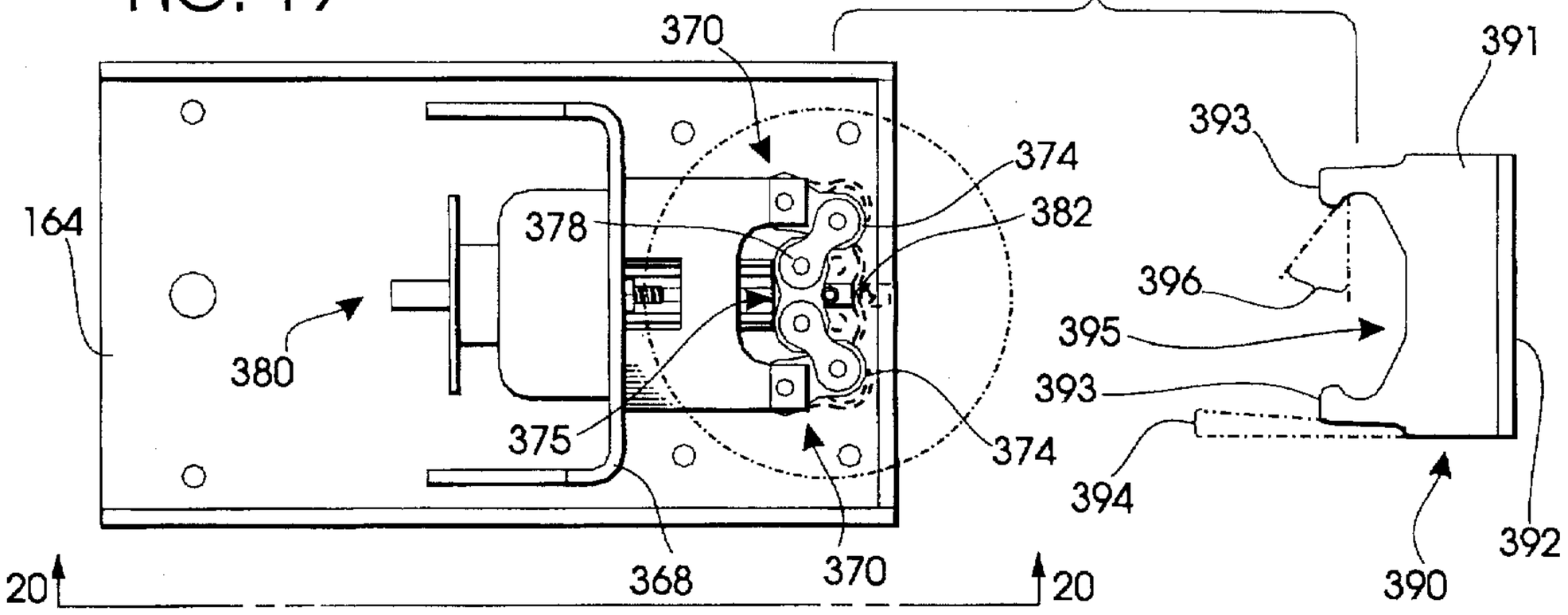

FIG. 19A

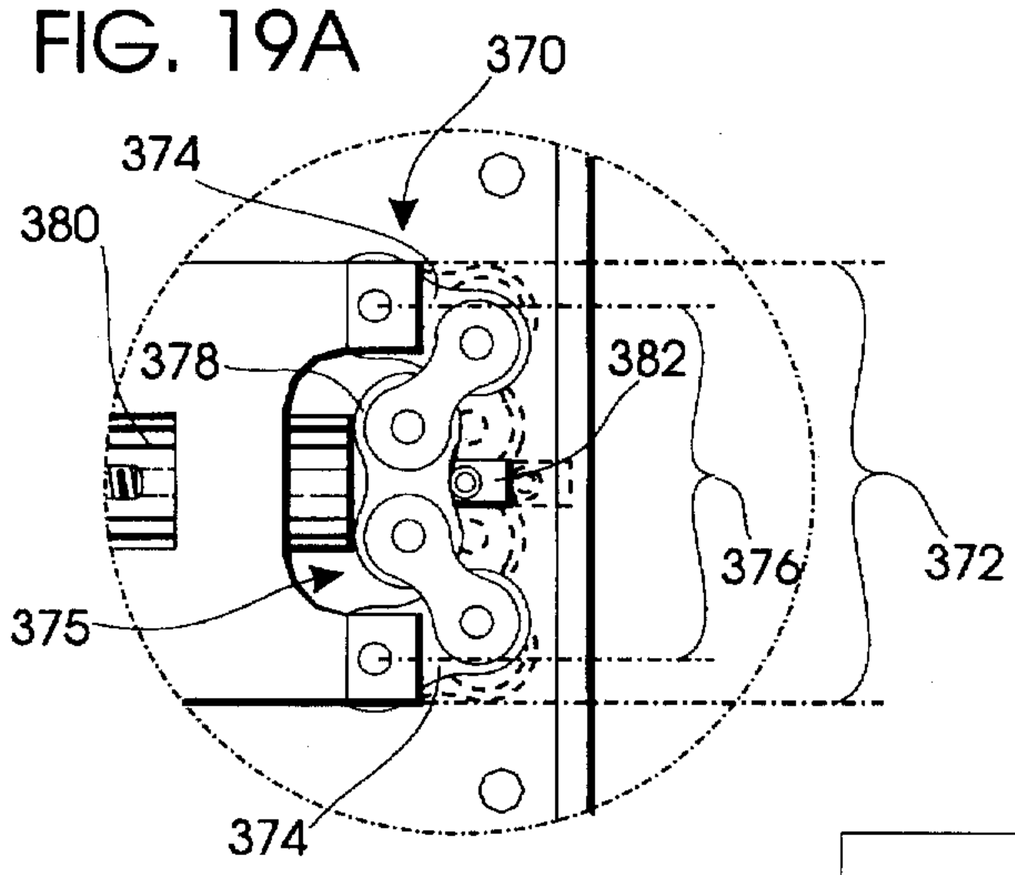

FIG. 20

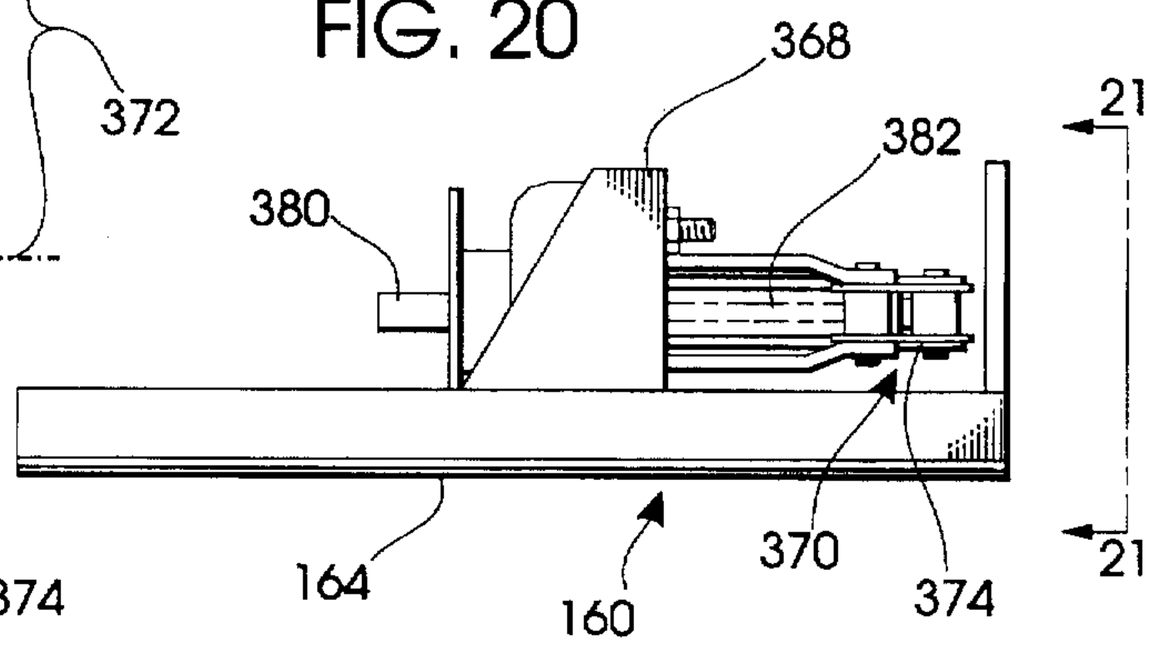

FIG. 21

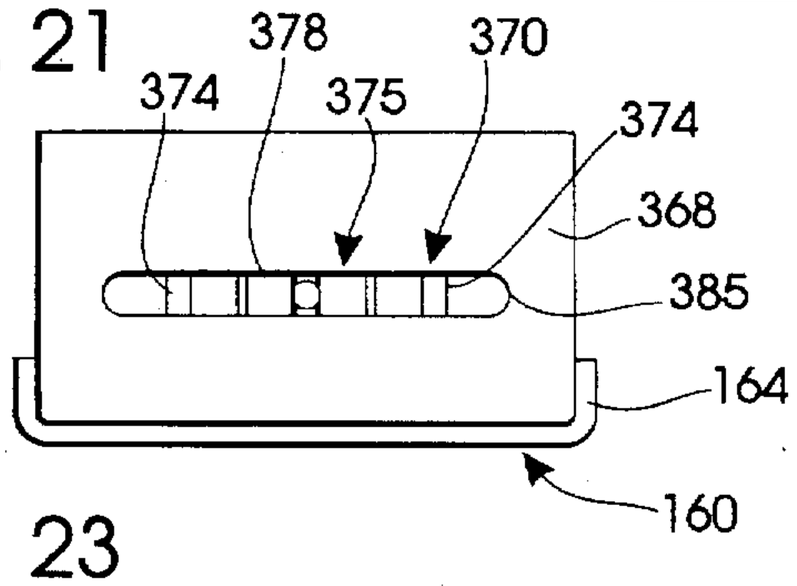

FIG. 22

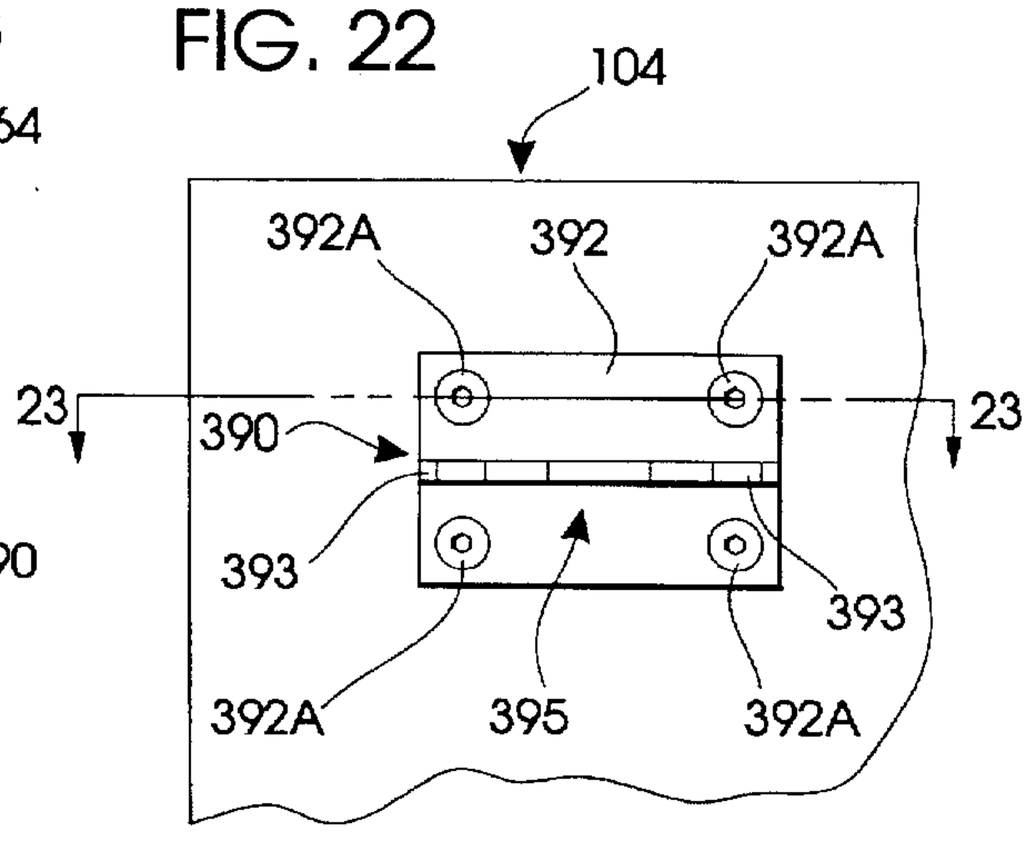

FIG. 23

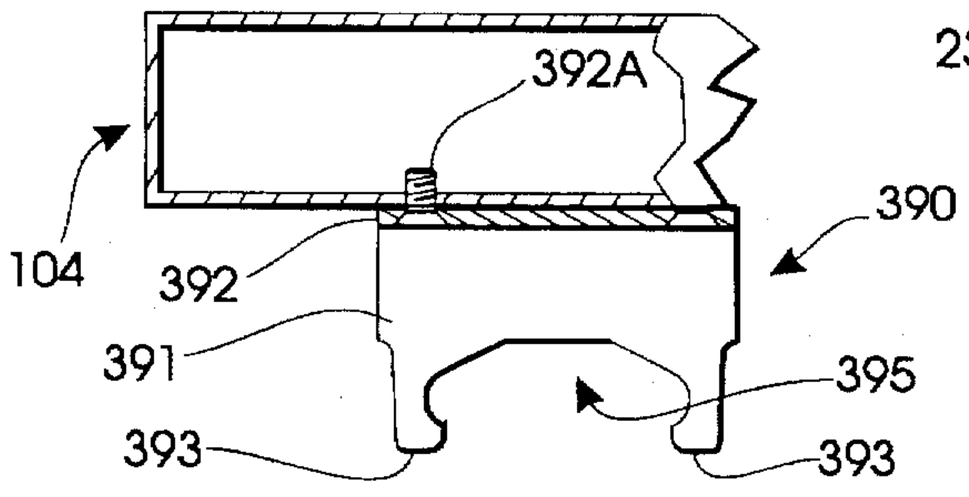

FIG. 24

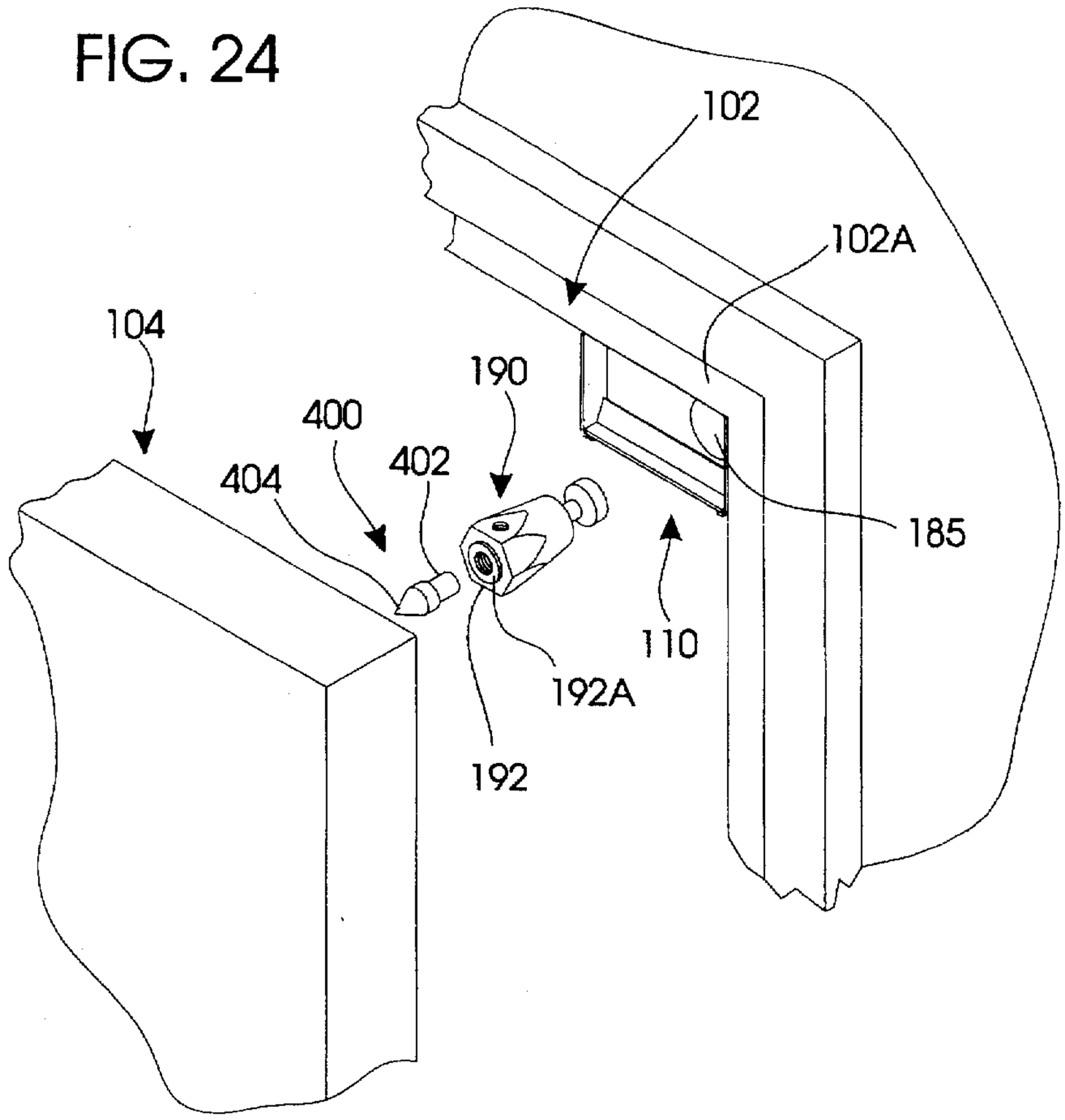
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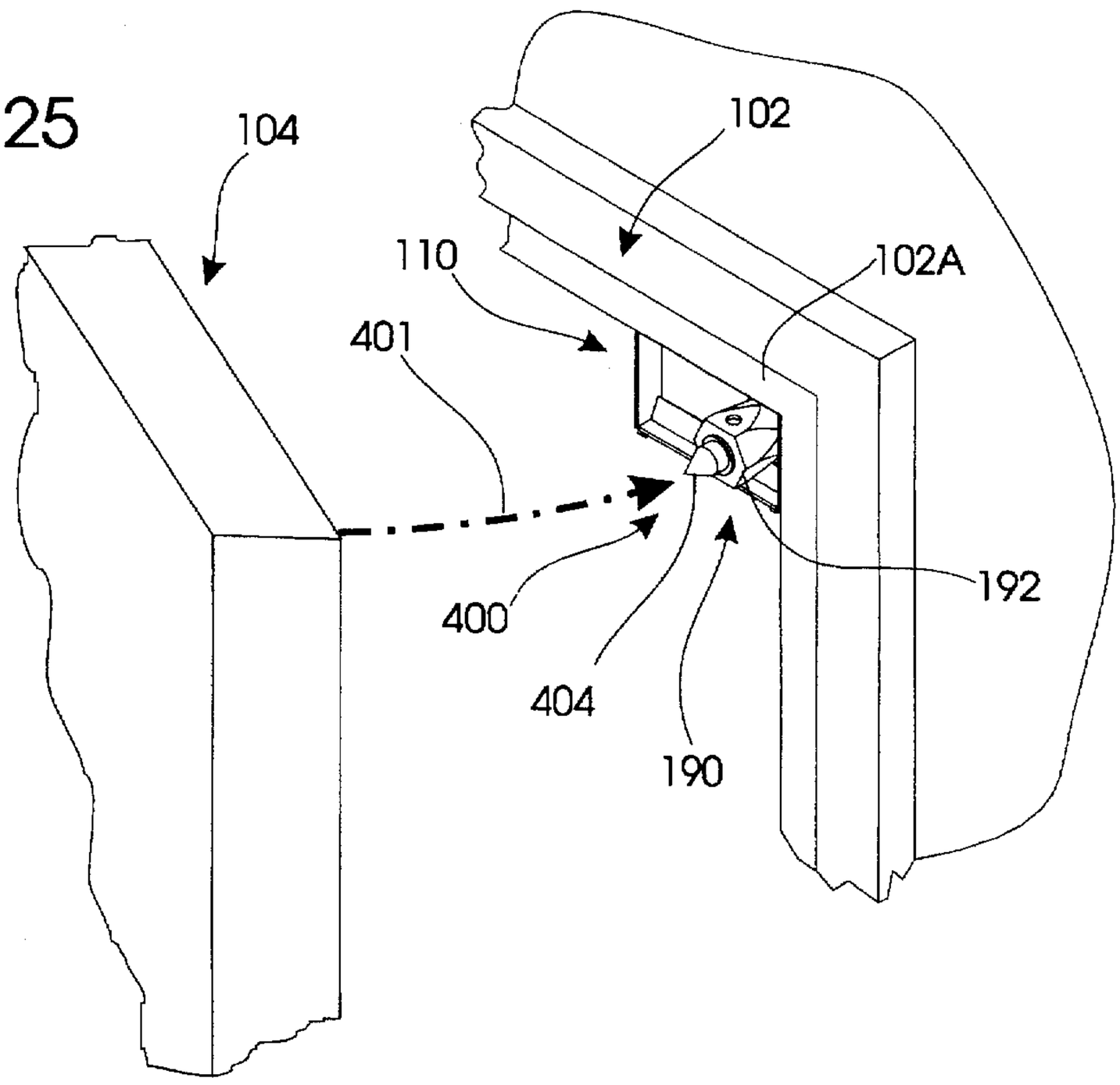
FIG. 25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EASILY INSTALLABLE DELAYED EGRESS LOCK SYSTEM

This is a continuation of U.S. patent application Ser. No. 08/645,179, filed May 13, 1996, now abandoned.

BACKGROUND OF THE INVENTION

I. Field of the Invention

This invention relates generally to security devices for exit doors. More particularly, the present invention relates to a delayed egress door lock associated with an arm paddle door lock for panic exits. Known prior art may be found in U.S. Class 292, subclasses 341.19, 201 and 92, respectively.

II. Description of the Prior Art

Incidences of forcible entry or exit from public and commercial buildings have increased dramatically during the recent past. Accordingly, the demand for reliable security systems has increased sharply. Public awareness of rising crime rates, increased attention to crime prevention efforts, and insurance considerations give further impetus to the development of dependable security systems.

Known prior art door locks can be generally categorized as conventional rim locks, deadbolt locks or paddle arm locks. Each door lock type is useful in certain operating environments. For example, rim and deadbolt locks are often used on entrance and exit doors while paddle arm locks are often used on emergency exit doors.

Conventional rim locks are simple, inexpensive locks that perform satisfactorily for many applications. Unfortunately, such locks are generally unsatisfactory for most security applications. They provide only a narrow, usually spring-biased bolt that penetrates a shallow port mounted to the door casing. With minimum force and simple tools, the bolt can be easily pried out of engagement with the catch.

Deadbolt locks, on the other hand, penetrate the door casing and project deeply into a port defined through the door frame. Even with the use of a pry bar, the end of the elongated bolt cannot easily be disengaged from its port. However, conventional deadbolt locks have disadvantages. For example, deadbolt locks often use a key access port. A well-equipped intruder may quickly manipulate the key port and gain forcible entry by destroying the locking components in the cylinder. Moreover, conventional deadbolt locks only secure the unhinged portion of the door. Thus, the lock does not prevent the would-be intruder from removing the door hinges to gain unauthorized entry.

Paddle arm locks are usually associated with emergency exits. These door locks typically comprise a rigid, hollow casing mounted to the interior of the door. A rotatable paddle arm handle mechanically releases an elongated, generally spring-biased latch bolt. One such paddle arm lock is shown in U.S. Pat. No. 5,139,292, issued Aug. 18, 1992, to L. Ralph Beals. The Beals patent discloses a preferred paddle arm lock that is hereby incorporated by reference. Paddle arm locks, including Beals' lock, also commonly comprise some form of built-in alarm system for alerting persons in the building that the door has been unlocked.

Another significant recent problem involves the abuse of emergency exits in commercial or public facilities. Since these emergency or panic exit doors provide rapid egress for individuals from a building, thieves and other wrongdoers have begun using these exits as convenient escape routes. Thus, there are circumstances where immediate availability of the exit is not desirable. One solution to such dastardly practices is to permanently encumber the door.

Unfortunately, this solution prevents door use during genuine emergency circumstances and is often prohibited by law.

As previously mentioned, some prior locks attempt to solve the problem by sounding an alarm when the door is unlocked. Unfortunately, such alarms generally fail to provide sufficient reaction time for authorized personnel to verify the emergency before opening the door. Furthermore, it is often desirable to maintain the secured status of emergency exits in some operating environments until authorized personnel can assist the evacuees. For example, it is desirable to maintain the security of hospital emergency exits to prevent patients from wandering out emergency exits without proper assistance.

In most modern buildings, the National Fire Protection Association (NFPA) and similar building code authorities permit the installation of delayed egress systems to prevent shoplifting. Such systems delay exit door activation after paddle depression for a brief period of time, generally fifteen to thirty seconds. An audible signal is generated during the delay period that allows security personal to assess the emergency situation and stop people from using the exits fraudulently.

National standards of performance for delayed egress locks have already been established. Such standards are found in ANSI/BHMA section 156.24. These standards establish operating parameters for timed release or delayed egress door locks that are different from other normal types of door locks.

Conventional delay mechanisms can be grouped as either primary or auxiliary lock delays. In other words, the delay mechanism is combined with the primary lock latch to form an unitary system or physically separated from the primary latch and it is combined with an auxiliary latch of some type.

Known prior art using primary lock delays are seen in U.S. Pat. Nos. 4,328,985, 5,011,199, 5,035,450 and 5,085,475. Most of these emergency exit devices combine a paddle door lock with an internal delaying mechanism directly associated with the door latchbolts. Normally, the paddle lock housing contains an internal linkage that connects the latchbolts to the paddle. The linkage moves the latchbolts in response to paddle depression to release the exit door. In the above referenced patents, the delay mechanism is generally interposed between the paddle and the latchbolts to prevent the immediate opening of the exit door.

One problem associated with interposed delay mechanisms is that they normally require complicated internal arrangements to function properly. These complicated arrangements are difficult to manufacture. They are also prone to failure in critical emergency situations.

Known prior art devices employing auxiliary delay latch systems are seen in U.S. Pat. Nos. 4,314,722 and 4,540,208. In both of these systems, the time delay mechanism controls an auxiliary lock that prevents door opening even though the primary lock has opened. However, these systems both employ control mechanisms at least partly dependent upon hydraulic fluids. One problem with fluid control devices is that they are often susceptible to variable operation during extreme temperature conditions, which could easily become problematic during a fire. Other prior art devices of general relevance include U.S. Pat. Nos. 4,682,801 and 4,871,204.

Another vexatious problem with most of the known prior art involves the difficulty of installation. It is often not a simple matter to install auxiliary locks or to replace primary locks with time delay devices. Thus, a need exits for an easily installable auxiliary time delay lock that may be retrofitted to existing primary locks.

Hence, it is desirable to provide a security locking system that positively locks a door against undesired intrusions and that also provides a delay mechanism to overcome the disadvantages associated with other delay mechanisms. An ideal delayed egress system should be easily retrofittable to exiting paddle arm locks. An easily installable system would be especially desirable.

SUMMARY OF THE INVENTION

The present invention provides an auxiliary time delay lock system that temporarily immobilizes doors after the primary lock opens. The subsequent time delay permits authorized personnel to verify the emergency before permitting uncontrolled egress from the facility. In other words, the delayed egress lock system requires that a predetermined time period expire between the initial effort of forcing entry through a locked door and the final act of gaining entry, permitting a sufficient reaction time to stop or report unauthorized egress.

The proposed locking system also withstands high withdrawal forces. The system's latch arrangement advantageously uses round surfaces to evenly dissipate and/or transfer the withdrawal forces to the frame of the door. Unlike other systems, the present system does not transmit the entire withdraw force of the door to a particular link in the latch housing. Thus, the present system is able to withstand higher withdrawal forces than other known systems. Another advantage of the present invention is the ease of both installing it and retrofitting it to existing doors and/or primary locks.

As mentioned previously, the disclosure of U.S. Pat. No. 5,139,292, issued Aug. 18, 1992, to L. Ralph Beals is incorporated herein by reference. The paddle arm lock disclosed by Beals overcomes several problems associated with prior art locks but does not teach a delay mechanism to prevent the problems discussed hereinabove. Preferably the system is installed to cooperate with a primarily lock, such as that proposed in Beals, that is already mounted upon the door. In such installations, the system is activated by the release of the primary door lock.

Three embodiments of the proposed system, a preferred embodiment and two alternatives, are discussed in greater detail hereinafter. However, since all embodiments are similar, like terms will be used throughout whenever possible. For example, all three embodiments comprise a control module, a latching mechanism and a bolt. Furthermore, the control module is identical for all three embodiments and all three embodiments mount similarly. The primary differences among the embodiments involves the respective shapes and dimensions of the keepers, actuators, their respective channels and the bolts.

Preferably, both the control module and latching mechanism are securely mounted to the upper corner of a selected door's jamb. Of course, the latching mechanism can be spaced away from the module as long as the mechanism is electrically connected to the module. The bolt is generally mounted oppositely on the door. However, with relatively minor modifications to the structure of the bolt and the control mounts, the bolt could be mounted on the jamb and the control module and latching mechanism could be mounted on the door.

The control module comprises a protective, hollow shell that generally houses all of the electrical components required to manage the system. In other words, the junctions, connections, circuitry, alarms and related equipment and wiring are all housed inside a protective shell. Preferably, the primary door lock is wired to the control module to signal when the primary latch releases so that the system begins counting down.

The latch mechanism comprises an elongated casing with an entry port. The casing protectively houses the internal latching components. The port receives the bolt when the door is closed. The internal components of the latching mechanism include the keeper and its actuator, the respective channels for both the keeper and actuator, and an electrical solenoid for controlling the keeper and actuator. The mechanism may also house alarms, testing devices or other equipment as necessary.

The bolt generally comprises a body supported by a base directly mounted to the door. The body terminates at a distal head. During use, most of the body and head enter and reside in the latch port.

Since most doors open and close arcuately, it is anticipated that a slight tapering at the bolt head will facilitate smooth entry into the mechanism. The angle of inclination most desirable is between four and eight degrees, most preferably 6.5 degrees. In the preferred embodiment, a half degree difference in the bolt head angle of inclination and the interior of the mechanism further prevents sticking or jamming. When the bolt is inserted into the port and the keeper is actuated, the keeper mates with a seat in the body to captivate the bolt therein. Of course, when the control releases the latch, the keeper must be dislodged from the seat. Thus, a converse displacement angle is required to dislodge the keeper from the seat. It has been found that a preferable displacement angle is between twenty-five and thirty-five degrees, preferably 30 degrees.

While the door is locked, the keeper captivates the bolt head in the latch port. In other words, as long as the control module provides power to the solenoid in the latching mechanism, the door remains locked even though the primary lock has opened. However, as soon as the primary lock releases, the control module begins counting down a preselected time period. At the end of the preselected time period, the control module interrupts the power supply to unlock the door. More specifically, the control module disrupts power to the solenoid, thereby de-energizing it and causing its plunger to contract. After the plunger withdraws, the keeper and actuator may move freely in their respective channels. Thereafter, whenever pressure is exerted on the door, the keeper moves out of the seat, permitting the withdrawal of the bolt from the port.

In the preferred embodiment, the keeper comprises a ball while the actuator comprises a slightly larger ball. The bolt comprises a body that has a conic head atop a cylindrical shaft. An annular ring defined in the shaft comprises the seat.

In the first alternative embodiment, the keeper comprises a flat disc while the actuator comprises a slightly larger flat disc. The bolt comprises a flat, tapered plate and the seat comprises an arcuate recess defined in the plate perimeter.

In the second alternative embodiment, the keeper comprises two spaced-apart chain links while the actuator comprises the links joining the keeper links. The bolt comprises a flat plate and the seat comprises an arcuate recess with a pair of opposed, spaced apart locking recesses therein.

Installation of the system may be accomplished in several easy steps. First, the control module and latch mechanism are secured to the upper door jamb corner. Next, the bolt is inserted into the latch mechanism and locked therein. Marking dyes are then placed on each attachment point of the bolt base. Finally, the door is forcibly shut. Each marking dye imprints the proper location for each attachment point on the

door. The imprints can then be conventionally drilled out for bolt attachment.

Thus, a principal object of the present invention is to provide an auxiliary time delay lock of the character described hereinbefore that temporarily prevents a door from opening for a predetermined time period after the primary lock releases.

A related object of the present invention is to provide an auxiliary time delay lock system that may be easily installed.

Another related object of the present invention is to provide an auxiliary time delay lock system that may be retrofitted to existing primary locks.

Yet another related object of the present invention is to provide an auxiliary time delay lock system that is particularly well suited for retrofitting to paddle arm locks with existing alarm signal devices.

A basic object of the present invention is to provide a time delay system that alerts authorized personnel when a door is accessed while temporarily preventing egress from the door.

Another basic object of the present invention is to prevent thieves from using emergency exits as quick escape routes.

A more basic object of the present invention is to provide an auxiliary lock system that retards unauthorized egress from a building.

A related object of the present invention is to provide a system that temporarily immobilizes emergency exits.

These and other objects and advantages of the present invention, along with features of novelty appurtenant thereto, will appear or become apparent in the course of the following descriptive sections.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following drawings, which form a part of the specification and which are to be construed in conjunction therewith, and in which like reference numerals have been employed throughout wherever possible to indicate like parts in the various views:

FIG. **1** is an environmental view of my Easily Installable Delayed Egress Lock System, with lower door, door jamb and surrounding wall cut away to allow enlargement of the view;

FIG. **2** is a front elevational view of the control module with its door in a closed position, the latching mechanism and door jamb mounting plate;

FIG. **3** is a rear elevational view of the components shown in FIG. **2**;

FIG. **4** is a left side elevational view taken generally along line **4—4** of FIG. **2**;

FIG. **5** is a right side elevational view taken generally along line **5—5** of FIG. **2**;

FIG. **6** is a top plan view taken generally along line **6—6** of FIG. **2**;

FIG. **7** is a bottom plan view taken generally along line **7—7** of FIG. **2**, with parts thereof broken away or omitted for clarity;

FIG. **8** is a front elevational view of the components shown in FIG. **2** but with the control module door open to expose the internal components and showing the internal mounting of the latching mechanism to the control module, with parts thereof broken away or omitted for clarity;

FIG. **9** is a partially exploded, fragmentary isometric view showing the preferred embodiment of the latching mechanism and the bolt, with parts thereof broken away or omitted for clarity;

FIG. **9A** is an enlarged, fragmentary isometric view of the encircled section shown in FIG. **9**;

FIG. **10** is a partially exploded, fragmentary isometric view showing the bolt attached to a door and a portion of the latching mechanism with parts omitted or broken away for clarity;

FIG. **11** is a top plan view of the preferred bolt and latching mechanism shown in FIG. **10**, with parts omitted or broken away for clarity;

FIG. **12** is a top plan view similar to FIG. **11**, but showing the bolt inside the port, with parts omitted or broken away for clarity;

FIG. **13** is a top plan view similar to FIGS. **11** and **12**, but showing the bolt locked inside the port, with parts omitted or broken away for clarity;

FIG. **14** is a partially fragmented, top plan view of a first alternative embodiment employing a disc keeper and actuator and a flat bolt, with parts broken away or omitted for clarity;

FIG. **15** is a partially fragmented, side elevational view of FIG. **14** as viewed from line **15—15**, with parts broken away or omitted for clarity;

FIG. **16** is a partially fragmented, end elevational view of FIG. **15** as viewed from line **16—16**, with parts broken away or omitted for clarity;

FIG. **17** is a front elevational view showing the bolt mounted to a door;

FIG. **18** is a cross-sectional view taken generally along line **17—17**, with parts broken away or omitted for clarity;

FIG. **19** is a top plan view of a second alternative embodiment employing a chain keeper and a flat bolt, with the dashed lines showing a moved position and with parts broken away or omitted for clarity;

FIG. **19A** is an enlarged, fragmentary top plan view of the encircled section shown in FIG. **19**;

FIG. **20** is a side elevational view of FIG. **19** as viewed from line **20—20**, with parts broken away or omitted for clarity;

FIG. **21** is a side elevational view of FIG. **20** as viewed from line **21—21**, with parts broken away or omitted for clarity;

FIG. **22** is a front elevational view showing the bolt mounted to a door;

FIG. **23** is a cross-sectional view taken generally along line **23—23**, with parts broken away or omitted for clarity;

FIG. **24** is a partially exploded, fragmentary environmental view illustrating the marking dye used during installation of the preferred embodiment; and,

FIG. **25** is a fragmentary environmental view with an arrow indicating door movement during installation.

DETAILED DESCRIPTION

With reference now to the accompanying drawings, a Easily Installable Delayed Egress Lock System constructed in accordance with the teachings of this invention is generally designated by the reference numeral **100** (FIG. **1**). System **100** is preferably mounted adjacent to the overhead section **102A** of door jamb **102** associated with the selected door **104**. The installation of system **100** is discussed in more detail hereinafter.

The system **100** comprises a control module **105**, a latching mechanism **110** and a bolt **115**. Preferably, system **100** is operatively associated with a primary door lock **120**.

Although system **100** may be used with any type of primary door lock, it is envisioned that door locks of the paddle arm lock type may be particularly utilized advantageously with the present invention. As mentioned previously, the disclosure of U.S. Pat. No. 5,139,292, issued Aug. 18, 1992, to L. Ralph Beals is especially well-suited for use with the present invention and its teachings are expressly incorporated herein by reference.

Referring back to FIG. **1**, door **104** is equipped with a commercially available paddle arm lock **122**. Preferably, the lock **122** is a Series THPA lock manufactured by Positive Lock Manufacturing of 402 east 39th street, Russellville, Ark. Of course, a similar model manufactured by another manufacturer would also be suitable.

As previously stated, three embodiments of the proposed system will be discussed in great detail hereinafter. However, since all embodiments are similar, like terms will be used throughout whenever possible. In other words, since all three embodiments comprise a control module, a latching mechanism and a bolt, these terms will be used for all embodiments. Furthermore, since the control module is identical for all three embodiments and since all three embodiments mount similarly, the control module and installation procedure will only be described in detail once.

In all three contemplated embodiments, the control module **105** and latching mechanism **110** secure to the door jamb **102** via bracket **112** while the bolt mounts on door **104** via stud **117** (FIGS. **1** and **9**). The control module **105** rigidly and operatively couples to the latching mechanism **110** (FIGS. **1–8**). Alternatively, the control module **105** could be remotely located as long as it was electrically connected to mechanism **110**.

An electrical cable **130** runs from an alarm **126** (discussed fully in the Beals patent) to control module **105**. Cable **130** is appropriately strung on wall **135** using keepers **135A** as necessary along a suitable route to control module **105**. Of course, any lock with a switch or other arrangement capable of electrically firing can be used to trigger system **100**. System **100** can also be wired into a smoke or fire alarm and triggered by their operation.

When a person presses against paddle **125**, the lock withdraws latchbolts **128A**, **128B** from the door jamb **102**. However, such paddle depression triggers system **100** via alarm **126**. As previously stated, system **100** prevents the door **104** from opening until a preselected time period expires. In addition to paddle depression, other devices, such as building alarms, smoke alarms, fire alarms, etc., depending upon the constraints of a particular installation, could be adapted to trigger system **100**.

Upon paddle depression, system **100** initiates a timer in control module **105**. Control module **105** comprises a protective, box-like, hollow shell **140** that houses the timing circuitry and related circuitry as well as various accessories for system **100**. Shell **140** can be readily constructed from any conventional rigid metal known in the industry. A hinged door **142** controls access to the shell interior **145** (FIG. **8**). Hinge **143** facilitates door movement while a door latch **144** prevents unauthorized persons from accessing interior **145**. Internal lock sensor **147** (FIG. **10**), signal light **148** and speakers **149** (FIGS. **2** and **8**), with corresponding sound emitting perforations **149A** in door **142**, are examples of accessories that may be utilized with system **100**.

A circuit board **150** controls the operation of system **100**. As will be immediately recognized by persons skilled in electronics, the circuit board **150** can be made in literally thousands of different configurations. Thus, board **150** will not be particularly described in detail. Board **150** receives input signals and power via wiring harness **155**. Harness **155** connects to board **150** conventionally. Signals are output from board **150** via harness **155** to accessories **148**, **149** and latching mechanism **110**.

The latching mechanism **110** is generally the same for all three embodiments. However, for clarity, the specific details of each latching mechanism for each embodiment will be discussed separately. In the preferred embodiment, latching mechanism **110** comprises an elongated, parallelepiped frame **160**. Frame **160** internally houses an internal keeper **170**, its actuator **175** and a locking solenoid **180** (FIG. **9**). Frame **160** comprises an upper mounting subframe **162** that receives a sliding bottom **164**. A flanged plate **165** anchors bottom **164** in subframe **162**.

The assembled frame **160** defines a terminal orifice **166** at end **167**. The subframe secures an internal block **168** adjacent orifice **166**. Block **168** secures the keeper **170**, actuator **175** and solenoid **180** (FIG. **9A**) inside frame **160**.

In the preferred embodiment, block **168** internally defines a keeper channel **172**. An inwardly projecting lip **173** restrains keeper **170** at the interior end of channel **172**. Keeper **170** comprises a sphere **174** (FIGS. **9A–13**) that may freely roll along channel **172**.

An actuator **175** normally abuts keeper **170** to restrict keeper movement along channel **172**. The actuator resides in a channel **176** that intersects channel **172**. While channel **176** preferably intersects channel **172** at approximately its midpoint, the intersection could be moved with a corresponding change in the dimensions of the keeper and actuator. However, experimental research has shown that a keeper to actuator ratio of approximately 1 to 4 provides the greatest resistance to withdrawal forces during a locked configuration while simultaneously requiring the smallest release forces during an unlocked configuration. The actuator preferably comprises a sphere **178** that rolls along channel **176**.

A conventional electrical solenoid **180** controls actuator **175** movement along channel **176**. When the system **100** locks door **104**, a plunger **182** protruding outwardly from solenoid **180** along channel **176** pushes the actuator toward channel **172** and keeper **170**. When the system **100** unlocks door **104**, the plunger **182** withdraws into solenoid **180** to permit actuator **175** to travel away from channel **172** and keeper **170**. Any subsequent withdrawal force on door **104** forces keeper **170** to move in against actuator **175**. Since the locking force of solenoid **180** has been withdrawn, the movement of keeper **170** against actuator **175** forces actuator **175** toward solenoid **180** along channel **176**. Such actuator movement permits keeper **170** to withdraw from its locking engagement against bolt **190** and subsequently unlocks door **104**. Block **168** further defines a tapered port **185** that accepts bolt **190**.

Bolt **190** comprises an elongated, tapering cylindrical shaft **191**. Shaft **191** tapers from a flat, circular base **192** to a terminating conical head **193**. Preferably, conical head **193** forms an angle of entry **194** that is between 4 and 8 degrees, most preferably 6.5 degrees. The angle of entry **194** facilitates smooth bolt entry into the port.

An annular seat **195** is defined in shaft **191** between the base **192** and the head **193**. Bolt **190** preferably mounts appropriately on door **104** via stud **117** as is discussed more fully hereinafter. When bolt **190** is inserted fully into port **185**, seat **195** may receive keeper **170**. While keeper **170** is inserted and retained in seat **195** by actuator **175**, door **104** remains locked. The walls of seat **195** form an angle of

withdrawal **196** that is between 25 and 35 degrees, most preferably 30 degrees. When keeper **170** is released, the angle of withdrawal **196** forces keeper **170** out of seat **195**. As mentioned previously, the alternative embodiments are structurally quite similar to the preferred embodiment. Nevertheless, both alternative embodiments will now be discussed with appropriate reference numerals for clarity.

In the first alternative embodiment (FIGS. **14–18**), block **268** internally defines a keeper channel **272**. An inwardly projecting lip **273** restrains keeper **270** at the interior end of channel **272**. Keeper **270** comprises a flat disc **274** that may freely move along channel **272**.

An actuator **275** normally abuts keeper **270** to restrict keeper movement along channel **272**. The actuator resides in a channel **276** that intersects channel **272**. Unlike the preferred embodiment, channel **276** forms a terminal end of channel **272**. Preferably, the keeper to actuator ratio remains approximately 1 to 4 to provide the greatest resistance to withdrawal forces during a locked configuration while simultaneously requiring the smallest release forces during an unlocked configuration. The actuator preferably comprises a flat disc **278** similar to disc **274**. Disc **278** also moves along channel **276**.

A conventional electrical solenoid **280** controls actuator **275** movement along channel **276**. When the system **100** locks door **104**, a plunger **282** protruding outwardly from solenoid **280** along channel **276** pushes the actuator toward channel **272** and keeper **270**. When the system **100** unlocks door **104**, the plunger **282** withdraws into solenoid **280** to permit actuator **275** to travel away from channel **272** and keeper **270**. Any subsequent withdrawal force on door **104** forces keeper **270** to move in against actuator **275**. Since the locking force of solenoid **280** has been withdrawn, the movement of keeper **270** against actuator **275** forces actuator **275** toward solenoid **280** along channel **276**. Such actuator **275** movement permits keeper **270** to withdraw from its locking engagement against bolt **290** and subsequently unlocks door **104**. Block **268** further defines a tapered port **285** that accepts bolt **290**.

Bolt **290** comprises an elongated, tapering flat shaft **291**. Shaft **291** tapers from a flat base **292** to a terminal head **293**. Preferably, the head **293** defines an angle of entry **294** that is between 4 and 8 degrees, most preferably 6.5 degrees. The angle of entry **294** facilitates smooth bolt entry into the port.

An arcuate seat **295** is defined in shaft **291** between the base **292** and the head **293**. Bolt **290** preferably mounts appropriately on door **104** via attachment points **292**A as is discussed more fully hereinafter. When bolt **290** is inserted fully into port **285**, seat **295** may receive keeper **270**. While keeper **270** is inserted and retained in seat **295** by actuator **275**, door **104** remains locked. The walls of seat **295** form an angle of withdrawal **296** that is between 25 and 35 degrees, most preferably 30 degrees. When keeper **270** is released, the angle of withdrawal **296** forces keeper **270** out of seat **295**.

In the second alternative embodiment (FIGS. **19–23**), block **368** defines a keeper channel **372**. The keeper **370** comprises a pair of spaced apart chain links **374** that may move freely through channel **372** (FIG. **19**A). An actuator **375** abuts keeper **370** to restrict keeper movement along channel **372**. The actuator moves through a smaller channel **376** that is inside channel **372**. Unlike the preferred embodiment and the first alternative embodiment, channel **376** is smaller than channel **372**. The actuator preferably comprises coupling chain links **378** that connect the spaced apart keeper links **374**.

A conventional electrical solenoid **380** controls actuator **375** movement along channel **376**. When the system **100** locks door **104**, a plunger **382** protruding outwardly from solenoid **380** along channel **376** pushes the actuator toward channel **372** and keeper **370**. Importantly, plunger travel is limited to prevent actuator **374** from going overcenter. When the system **100** unlocks door **104**, the plunger **382** withdraws into solenoid **380** to permit actuator **375** to travel away from channel **372** and keeper **370**. Any subsequent withdrawal force on door **104** forces keeper **370** to move in against actuator **375**. Since the locking force of solenoid **380** has been withdrawn, the movement of keeper **370** against actuator **375** forces actuator **375** toward solenoid **380** along channel **376**. Such actuator **375** movement permits keeper **370** to withdraw from its locking engagement against bolt **390** and subsequently unlocks door **104**. Block **368** further defines a port **385** that accepts bolt **390**.

Bolt **390** comprises an elongated, flat shaft **391**. Shaft **391** extends from a flat base **392** to a terminal, split head **393**. Bolt **390** preferably mounts appropriately on door **104** via attachment points **392**A as is discussed more fully hereinafter. Preferably, head **393** forms an angle of entry **394** that is between 4 and 8 degrees, most preferably 6.5 degrees. The angle of entry **394** facilitates smooth bolt entry into the port.

An arcuate seat **395** is defined in shaft **391** between the base **392** and the split head **393**. Bolt **390** preferably mounts appropriately on door **104** as is discussed more fully hereinafter. When bolt **390** is inserted fully into port **385**, seat **395** may receive keeper **370**. While keeper **370** is inserted and retained in seat **395** by actuator **375**, door **104** remains locked. The walls of seat **395** form an angle of withdrawal **396** that is between 25 and 35 degrees, most preferably 30 degrees. When keeper **370** is released, the angle of withdrawal **396** forces keeper **370** out of seat **395**.

In the preferred embodiment, the solenoid **180** draws 15 W of power while in a locked configuration. While in this locked configuration, a withdrawal force of 450 lbs is required to open door **104**. Keeper sphere **174** and actuator sphere **178** transfer the withdrawal forces to the channel walls of block **168**. Block **168** transfers the withdrawal forces to the frame **160**. Frame **160** transfers the withdrawal forces to door jamb **102** via mounting hardware (bolts, screws, etc.).

Installation

One significant advantage of system **100** over known prior art locks is the simplicity of the installation procedure for system **100**. As can be most readily seen in FIGS. **24** and **25**, system **100** can be easily installed in most environments with a minimum of effort.

The first step in installing system **100** is to secure mounting bracket **112** to door jamb **102** using conventional bolts, screws, etc. (FIG. **9**). In practice, it has been found simplest to partially assemble latching mechanism **110** to ascertain the appropriate spacing from door **104** along jamb **102** for the mounting bracket location. After the mounting bracket **112** is rigidly affixed to door jamb **102**, latching mechanism **110** and control module **105** can be conventionally secured to mounting bracket **112** on door jamb **102** as seen in FIG. **9**. Of course, the control module can then be conventionally wired to the primary lock **120** or other triggering device.

Next, bolt **190** is simply inserted into port **185** and locked in place. A marking dye **400** is then placed on the attachment point **192**A (or points **292**A or **392**A in the alternative embodiments) on base **192**. With the marking dye appropriately placed, door **104** is forcibly closed as indicated by

arrow **401**. During closure, door **104** impacts upon marking dye **400**. This impact imprints the proper location for attachment point **192**A (or **292**A or **392**A) on door **104**.

The marking dye **400** is then removed from the attachment point **192**A (or **292**A or **392**A) and bolt **190** (or **290** or **390**) is subsequently attached to door **104**. In the preferred embodiment, dye **400** comprises a simple insert **402** with a pointed terminal tip **404**. Of course, the dyes for each of the alternative embodiments would be identical except they would fit over attachment points **292**A and **392**A respectively instead of inserting into them.

The above described installation procedure quickly and efficiently permits system **100** to be retrofitted to existing primary locks **120** or installed independently.

From the foregoing, it will be seen that this invention is one well adapted to obtain all the ends and objects herein set forth, together with other advantages which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An emergency exit door comprising:

a door with a primary paddle arm lock,

an auxiliary door locking system triggered when said primary door lock is depressed, said system comprising:

a bolt comprising a body and an annular seat defined in said body;

a latching mechanism for receiving said bolt when said door is closed, said mechanism comprising:

keeper means for normally captivating said bolt, said keeper means comprising a displaceable spherical keeper adapted to selectively mate within said annular seat and a spherical actuator with a diameter at least two times larger than the diameter of said keeper for displacing said keeper when so activated by plunger means for selectively activating said spherical actuator;

a port aligned with said bolt for receiving same;

a first tubular channel defined in said mechanism intersecting said port for housing said keeper;

a second tubular channel defined in said mechanism terminally intersecting said first channel for housing said actuator and,

timer means for temporarily delaying unlocking in response to the depression of said paddle arm lock.

2. The door as defined in claim **1** wherein said bolt further comprises an entry angle to facilitate bolt entry into said port and said seat comprises a displacement angle to dislodge said keeper therefrom during withdrawal from said port.

3. The door as defined in claim **2** wherein said entry angle is between four and eight degrees and said displacement angle is between twenty-five and thirty-five degrees.

4. The door as defined in claim **3** further comprising marking means for designating the location of said bolt on said door and wherein said bolt is adapted to selectively secure said marking means temporarily.

5. A fail safe auxiliary door locking system for use with a primary paddle arm lock to delay door opening, said system comprising:

a bolt comprising a body and an annular seat defined in said body;

a latching mechanism for receiving said bolt when said door is closed, said mechanism comprising:

keeper means for normally captivating said bolt, said keeper means comprising a displaceable keeper disposed within said mechanism for selectively engaging said annular seat, said keeper being spherical and adapted to mate within said seat, and an actuator being spherical for displacing said keeper when selectively activated by plunger means, said spherical actuator comprising a diameter larger than the diameter of said spherical keeper to geometrically increase the force necessary to withdraw said keeper while said keeper is mated in said seat;

a port aligned with said bolt for receiving same;

a first tubular channel defined in said mechanism intersecting said port for housing said keeper;

a second tubular channel defined in said mechanism terminally intersecting said first channel for housing said actuator; and,

timer means for temporarily delaying unlocking in response to said primary door latch.

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